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ABSTRACT

The Nevada Mathematics Standards provide the framework for a comprehensive K-12 mathematics program and guide curriculum, instruction, and assessment as well as other policies and practices that affect student learning. The standards are intended to serve as a foundation for teachers and curriculum specialists as they create curriculum and adopt teaching practices relevant to the needs, strengths, and diversity of Nevada's students and communities. This document begins with a brief introduction and overview outlining and explaining a vision for mathematics teaching and learning in Nevada, the purpose of the document, and the structure/organization of the document. The two main sections of the document provide content standards and indicators of progress for grades K-8 and 12. Also included are performance level descriptors for grades 2, 3, 5, 8, and 12. (MM)

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ED 466 406

Nevada Mathematics

Content Standards for Kindergarten and Grades 1 through 8 and 12

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[and] Performance Level Descriptors

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Nevada Mathematics Standards

Introduction

Comprehensive mathematical knowledge is essential for success in today's world. Society needs individuals who have sound estimation skills and number and spatial sense, who are competent using and interpreting data, and who can use appropriate technology resources to solve problems and make informed decisions. These skills are essential if students are to become successful citizens, life-long learners, and competitive workers in a global market place.

Mathematics is a basic component of every student's education. Within mathematics, technology should be regarded as a tool that can facilitate a student's understanding of quantitative relationships and that can increase computational proficiency in problem-solving situations. In elementary school, calculators are valuable tools as students explore patterns and investigate mathematical situations. Students should not, however, depend on calculators to help them solve basic computation problems. It is critical that students thoroughly develop basic computational skills at a young age. Technology can be used by students to strengthen and extend their understanding of concepts, explore mathematical functions, engage in problem-solving activities, employ real world applications, and verify results of mathematical activities. When technology is combined with a student's understanding of underlying mathematical concepts, learning is enhanced. Technology can support student learning and provide all students with the tools they need to master the Nevada standards.

The *Nevada Mathematics Standards* are intended to establish common expectations for local communities to develop a clear, shared understanding of what all students should know and be able to do at key points in their K-12 educational careers. The document includes five content standards: Numbers, Number Sense, and Computation; Patterns, Functions, and Algebra; Measurement; Spatial Relationships and Geometry; and Data Analysis. Each of these content standards is essential to accomplishing the goals for mathematics education listed below.

<u>Goals of Mathematics Education in Nevada</u>

- the knowledge of basic mathematical facts and relationships and the ability to perform computations;
- the ability to make sound estimations and to make sense of number relationships;
- the ability to read, interpret, and create graphs, tables, and charts;
- the ability to make geometric observations, measurements, and constructions; and
- the ability to understand the effective, appropriate, and efficient use of models and mathematical tools, including calculators and computer technology.

Additionally, these standards include four process standards: Problem Solving, Mathematical Communication, Mathematical Reasoning, and Mathematical Connections. The processes described within these four standards are also carefully integrated within the content standards to emphasize the interconnectedness among the process and content standards. This integration is meant to emphasize the importance of teaching mathematics within the context of an application so students can not only compute but also can use their computational skills to reason and solve problems.

The *Nevada Mathematics Standards* are intended to provide the framework for a comprehensive K-12 mathematics program and are intended to guide curriculum, instruction, and assessment as well as other policies and practices that affect student learning. They will serve as a foundation for teachers and curriculum specialists as they create curriculum and adopt teaching practices relevant to the needs, strengths, and diversity of Nevada's students and communities. The standards will also provide clear direction for meaningful pre-service and in-service professional development. In essence, the standards will help Nevada's school districts build cohesive and comprehensive systems for ensuring that all students achieve at high levels.

This edition of the Nevada Mathematics Standards contains supplemental information not previously included in previous editions. First, suggested interdisciplinary links have been noted at the bottom of each box, when applicable, for grades 2, 3, 5, 8 and 12. Second, for the Benchmark Grades of 2, 3, 5, 8 and 12, each of the benchmark standards were prioritized based on a three-part framework which included Enduring Knowledge, Important Knowledge and Knowledge Worth Being Familiar With. In addition, for each of the benchmark standards in grades 3, 5, 8, and 12, a determination was made as to whether the standard would be assessed locally by school district personnel or through a state assessment. In doing so, it was assumed that all standards would be assessed at the local level but that only some of the standards are appropriate for assessment at the state level. Listed below are the keys to the coding used throughout the document regarding interdisciplinary links by subject area, prioritization framework and assessment level.

KEY TO INTERDISCIPLINARY LINKS
(Located at the bottom of each box, as applicable, for Grades 2, 3, 5, 8, and 12)

C = Civics E = English Language Arts Ec = Economics G = Geography

H = History M = Mathematics S = Science

KEY TO PRIORITY FRAMEWORK AND ASSESSMENT LEVEL

E = Enduring. Complex, engaging, "big ideas," will require more in-depth knowledge.
I = Important to know and do. Students should retain detailed but not extensive knowledge.
W = Worth being familiar with. Students should have awareness of key people, ideas, concepts, and terms.

L = Nevada Academic Standards that are assessable at the local level ONLY.
S = Nevada Academic Standards that are assessable at the state and local levels.

The coding for both the priority framework and the assessment level are located at the top, right hand corner of each box. Priority framework coding is provided for Grades 2, 3, 5, 8, and 12. Assessment level coding is provided for Grades 3, 5, 8, and 12 only. As an example, the letters E/L found at the top right hand corner of a 3rd grade benchmark standard would indicate that the standard requires Enduring knowledge and will only be assessed at the local level.

Numbers, Number Sense, and Computation

Content Standard 1.0: *To solve problems, communicate, reason, and make connections within and beyond the field of mathematics, students will accurately calculate and use estimation techniques, number relationships, operation rules, and algorithms; they will determine the reasonableness of answers and the accuracy of solutions.*

By the end of **Kindergarten,** students know and are able to:	By the end of **Grade 1,** students know and are able to do everything required in the previous grade and:	By the end of **Grade 2,** students know and are able to do everything required in the previous grades and:	By the end of **Grade 3,** students know and are able to do everything required in the previous grades and:	By the end of **Grade 4,** students know and are able to do everything required in the previous grades and:	
1.K.1 Use concrete objects to model simple sums and differences.	1.1.1 Identify and model basic addition facts (sums through 10) and the corresponding subtraction facts.	I 1.2.1 Identify and model basic addition facts (sums to 18) and the corresponding subtraction facts; immediately recall basic addition facts (sums through 10) and the corresponding subtraction facts.	E/S 1.3.1 Immediately recall and use addition, subtraction, and multiplication facts to 81.	1.4.1 Immediately recall and use multiplication and corresponding division facts through 12s.	Facts
		I 1.2.2 Add and subtract multi-**digit**[1] numbers without **regrouping**.	I/L 1.3.2 Add and subtract multi-digit numbers with regrouping.		Application

Digit – A digit is any one of the basic symbols used to write a numeral. For example, the numeral 23 is made up of the digits 2 and 3.

Regrouping – Regrouping occurs in a mathematical operation when numbers are renamed such as 2 tens and 14 ones is renamed as 34 or vice-versa, e.g., "carrying" and "borrowing".

[1] Words in bold text are defined at the bottom of the page.

Content Standard 1.0: Numbers, Number Sense, and Computation

By the end of **Kindergarten,** students know and are able to:	By the end of **Grade 1,** students know and are able to do everything required in the previous grade and:	By the end of **Grade 2,** students know and are able to do everything required in the previous grades and:	By the end of **Grade 3,** students know and are able to do everything required in the previous grades and:	By the end of **Grade 4,** students know and are able to do everything required in the previous grades and:	
	1.1.3 Write, model, and describe one-step addition and subtraction problems.	I 1.2.3 Generate and **solve** one-step addition and subtraction problems based on practical situations.	E/S 1.3.3 Generate and solve 2-step addition and subtraction and 1-step multiplication problems based on practical situations using pencil and paper, mental computation, and estimation.	1.4.3 Generate and solve 2-step multiplication and division problems based on practical situations using pencil and paper, mental computation, and estimation.	Word Problems and Number Theory
		E 1.2.4 Use decimals to show money amounts.	E/S 1.3.4 Add and subtract decimals using money as a model.	1.4.4 Multiply and divide money amounts by a one-digit whole number producing a solution with no remainder.	Decimals and Money
1.K.5 Count to 20.	1.1.5 Use the inherent patterns in numbers to **skip count** by 1's, 2's, 5's, and 10's to 100.	W 1.2.5 Use the patterns in numbers to skip count.	I/L 1.3.5 Model and explain multiplication, including as repeated addition.	1.4.5 Multiply and divide multi-digit numbers by a one-digit number with regrouping, model and explain division including as repeated subtraction.	Computation

Skip Count – To count by multiples of a number (count by twos, fives, tens, etc.)
Solve – To find all the solutions of an equation or other mathematical problem.

Content Standard 1.0: Numbers, Number Sense, and Computation

By the end of **Kindergarten,** students know and are able to:	By the end of **Grade 1,** students know and are able to do everything required in the previous grade and:	By the end of **Grade 2,** students know and are able to do everything required in the previous grades and:	By the end of **Grade 3,** students know and are able to do everything required in the previous grades and:	By the end of **Grade 4,** students know and are able to do everything required in the previous grades and:	
1.K.6 Recognize, read, and write numbers from 0-10.	1.1.6 Read, write, order, and compare numbers from 0-100.		E/L 1.3.6 Read, write, order, and compare numbers from 0-999; read and write number words.	1.4.6 Read, write, order, and compare **whole numbers**.	Comparison and Ordering
1.K.7 **Estimate** the number of objects in a set to 10 and **verify** by counting; use ordinal positions first to third.	1.1.7 Estimate the number of objects in a set to 10; read and write number words to 10 and use ordinal positions first to tenth.	I 1.2.7 Estimate the number of objects in a set to 20; read and write number words to 20 and use ordinal positions first to twentieth.	W/L 1.3.7 Round to nearest tens and hundreds to determine reasonableness of the answer; read and write number words.	1.4.7 Use estimation to determine the reasonableness of an answer.	Estimation and Rounding
1.K.8 Match the number of objects to the correct numeral, 0-10.	1.1.8 Use, model, and identify **place value** positions of 1's and 10's.	I 1.2.8 Use, model, and identify place value positions of 1's, 10's, and 100's.	I/S 1.3.8 Use, model, and identify place value positions up to 10,000.	1.4.8 Use and identify place value positions of whole numbers.	Place value
	E 1.1.9 Identify and model a whole; identify and model 1/2.	1.2.9 Identify, model, and label 1/2 and 1/4 as parts of a whole.	I/S 1.3.9 Model, sketch, and label fractions with **denominators** to 10; write fractions with numbers and words.	1.4.9 Identify and compare fractions with like denominators using numbers, models, and drawings.	Fractions

Denominator – The part of a fraction that defines the number of parts into which the whole number is divided.
Estimate – To give an approximate and reasonable answer for an arithmetical exercise without the need of calculating the exact answer.
Place Value – The value of a digit as determined by multiplying its face value by its place value. For example, in the numeral 643, the 6 is in the "hundreds place" and represents a value of 600.
Verify – The process of demonstrating or proving that a response is correct.
Whole Numbers – The set of counting numbers and the number zero, i.e., (0, 1, 2, 3, 4…).

Patterns, Functions, and Algebra

Content Standard 2.0: *To solve problems, communicate, reason, and make connections within and beyond the field of mathematics, students will use various algebraic methods to analyze, illustrate, extend, and create numerous representations (words, numbers, tables, and graphs) of patterns, functions, and algebraic relations as modeled in practical situations.*

By the end of **Kindergarten,** students know and are able to:	By the end of **Grade 1,** students know and are able to do everything required at the previous grade and:	By the end of **Grade 2,** students know and are able to do everything required in the previous grades and:	By the end of **Grade 3,** students know and are able to do everything required in the previous grades and:	By the end of **Grade 4,** students know and are able to do everything required in the previous grades and:	
2.K.1 Sort and describe objects by similar **attributes**; recognize and replicate a pattern.	2.1.1 Recognize, describe, **extend**, and create simple repeating patterns using symbols, objects, and **manipulatives**.	I 2.2.1 Recognize, describe, extend, and create repeating and increasing patterns using symbols, objects, and manipulatives; use patterns and their extensions to solve problems.	I/S 2.3.1 Recognize, describe, and create patterns using numbers; use number patterns and their extensions to solve problems. S 20.3.2	2.4.1 Identify, describe, and represent numeric and geometric patterns and relationships.	Patterns
		2.2.2 Generate and solve problems based on various numerical sentences; represent mathematical situations using numbers, symbols, and words.			Relationships

Attribute – Characteristic of an object, such as color, shape, size, etc.
Extend (pattern) – To continue a pattern or sequence with the same rules.
Manipulatives – Tools, models, blocks, tiles, and other objects which are used to explore, represent, and extend mathematical ideas and to solve mathematical problems.

Content Standard 2.0: Patterns, Functions, and Algebra

By the end of **Kindergarten**, students know and are able to:	By the end of **Grade 1**, students know and are able to do everything required at the previous grade and:	By the end of **Grade 2**, students know and are able to do everything required in the previous grades and:	By the end of **Grade 3**, students know and are able to do everything required in the previous grades and:	By the end of **Grade 4**, students know and are able to do everything required in the previous grades and:	
		I 2.2.3 Use **variables** and open sentences to express relationships.	I/S 2.3.3 Identify missing terms and missing numbers in open number sentences involving number facts in addition and subtraction.	2.4.3 Find solutions to given equalities from a given **replacement set**, (e.g. find the solution to 3 X 7 =_____, given the replacement set {19, 20, 21}).	Variables (Unknowns)
2.K.4 Identify and create sets of objects with unequal amounts, describing them as more or less.	2.1.4 Create, compare, and describe sets of objects as more, less, or equal (amounts).	I 2.2.4 Generate and solve problems based on various numerical sentences; represent mathematical situations using numbers, symbols, and words.	I/S 2.3.4 Complete number sentences with the appropriate words and symbols for addition, subtraction, less than, greater than, and equal to (+, –, <, >, =).		Number Sentences and Equations
					Algebraic Basics[2]
					Linear Equations
		I 2.2.7 Model, explain and solve a number sentence involving addition and subtraction.			Equation Solutions

Replacement Set – A collection of potential values to be used in place of the variable in an open mathematical sentence.
Variable – A variable is a symbol, such as a letter, box, star, etc., used to represent an unknown or undetermined value in an expression or number sentence.

[2] This topic is a placeholder for content taught in subsequent grades.

Measurement

Content Standard 3.0: *To solve problems, communicate, reason and make connections within and beyond the field of mathematics, students will use appropriate tools and techniques of measurement to determine, estimate, record, and verify direct and indirect measurements.*

By the end of **Kindergarten,** students know and are able to:	By the end of **Grade 1,** students know and are able to do everything required at the previous grade and:	By the end of **Grade 2,** students know and are able to do everything required in the previous grades and:	By the end of **Grade 3,** students know and are able to do everything required in the previous grades and:	By the end of **Grade 4,** students know and are able to do everything required in the previous grades and:	
3.K.1 Compare and order objects by size communicating their similarities and differences.	3.1.1 Compare and order objects by length and weight, communicating their similarities and differences.	I 3.2.1 Compare and order objects by various measurable **attributes** (e.g., time, temperature, length, weight, **capacity** and **area**) communicating their similarities and differences. S 2.2.1			Comparison and Ordering
	3.1.2 Compare and measure length and weight, using non-standard measurement.	I 3.2.2 Compare objects to standard whole units to find objects that are greater than, less than, and/or equal to a given unit (e.g., inch, yard, centimeter, meter). S 2.2.1	W/L 3.3.2 Select and use appropriate units of measurement; measure to a required degree of **accuracy**, and record results. S 18.3.2; S 23.3.5	3.4.2 Measure and compare length in inches, feet, yards, and miles to the nearest 1/2, 1/4); measure and compare lengths in metric units (millimeter, centimeter, meter, kilometer; **convert** within each system.	Measurement

Accuracy – Correctness, usually referring to numerical computations. The accuracy of a table may mean either (1) the number of significant digits appearing in the table; (2) the number of correct places in computations made with the table.
Area –The size of a two-dimensional region typically measured in square units.
Capacity – The maximum amount of liquid a container can hold.
Convert – (Within a measurement system.) To change from one unit of measure to another. For example, 1 yard equals 36 inches.

Content Standard 3.0: Measurement

By the end of **Kindergarten**, students know and are able to:	By the end of **Grade 1**, students know and are able to do everything required in the previous grade and:	By the end of **Grade 2**, students know and are able to do everything required in the previous grades and:	By the end of **Grade 3**, students know and are able to do everything required in the previous grades and:	By the end of **Grade 4**, students know and are able to do everything required in the previous grades and:	
			E/L 3.3.3 Estimate and use measuring devices with **standard** and **non-standard units** to measure length, surface area, liquid **volume**, capacity, temperature, and weight, communicating the concepts of more, less, and equivalent. S 3.3.1	3.4.3 Communicate the difference between **perimeter** and **area**; describe and determine the perimeter of **polygons** and the area of rectangles (including squares).	Estimation and formulas
3.K.4 Identify and sort pennies, nickels, and dimes.	3.1.4 Determine the value of any set of pennies, nickels, and dimes.	E 3.2.4 Determine the value of any given set of coins. Ec 5.2.1	E/S 3.3.4 Read, write, and use money notation determining possible combinations of coins and bills to equal given amounts. Ec 5.3.1	3.4.4 Determine totals for monetary amounts in problem- solving situations.	Money
				3.4.5 Describe and determine the perimeter of polygons and the area of rectangles (including squares).	Proportion and Ratio

Area – The size of a region measured in number of square units (i.e., inches squared, square feet).
Non-standard units – Informal units of measure such as hand-full, arm's length, and stride.
Perimeter – The sum of the lengths of the sides of a two-dimensional figure.
Polygon – A simple, closed plane figure with sides consisting of line segments.
Standard Units – Units of measure that have an accepted value like inch, cup, meter, and pound.
Volume – The size of a three-dimensional shape typically measured in cubic units.

Content Standard 3.0: Measurement

By the end of **Kindergarten,** students know and are able to:	By the end of **Grade 1,** students know and are able to do everything required in the previous grade and:	By the end of **Grade 2,** students know and are able to do everything required in the previous grades and:	By the end of **Grade 3,** students know and are able to do everything required in the previous grades and:	By the end of **Grade 4,** students know and are able to do everything required in the previous grades and:	
3.K.6 Recite, in order, the days of the week.	3.1.6 Recite the months of the year in order; use a calendar to identify days, weeks, months, and year; read time to the nearest hour; distinguish between day and night.	E 3.2.6 Read time to the nearest quarter hour; distinguish between A.M. and P.M.	E/S 3.3.6 Tell time to the nearest minute, using analog and digital clocks, and identify elapsed time.		Time

Spatial Relationships and Geometry

Content Standard 4.0: *To solve problems, communicate, and make connections within and beyond the field of mathematics, students will identify, represent, verify, and apply spatial relationships and geometric properties.*

By the end of **Kindergarten,** students know and are able to:	By the end of **Grade 1,** students know and are able to do everything required in the previous grade and:	By the end of **Grade 2,** students know and are able to do everything required in the previous grades and:	By the end of **Grade 3,** students know and are able to do everything required in the previous grades and:	By the end of **Grade 4,** students know and are able to do everything required in the previous grades and:	
4.K.1 Identify **two-dimensional** shapes (circles, triangles, rectangles including squares) regardless of position.	4.1.1 Name, sort, and sketch two-dimensional shapes (circles, triangles, rectangles including squares) regardless of position.	E 4.2.1 Describe, and compare two dimensional shapes (circles, triangles, rectangles including squares) regardless of position. S 2.2.1	I/S 4.3.1 Describe, sketch, compare, and contrast plane geometric figures. S 2.3.1	4.4.1 Identify, draw, and classify angles according to their measurement, including **right**, **obtuse**, and acute.	Two–Dimensional Shapes
4.K.2 Use position words (e.g., middle, before, down) to place objects.	4.1.2 Use position words (e.g., between, left, near) to describe location of objects.	E 4.2.2 Compare the size (larger and smaller) of similar two-dimensional figures (e.g., circles, triangles); identify **congruent** shapes. E 9.2.1	W/L 4.3.2 Demonstrate and describe the motion (transformation) of geometric figures as a slide, **rotation**, or a flip.	4.4.2 Represent concepts of similarity congruence, and **symmetry** using transformational motion.	Congruence, Similarity, and Transformations

Congruent – Figures that have the same size and shape.
Obtuse Angle – An angle with a measure that is greater than 90 degrees and less than 180 degrees.
Right Angle – An angle that measures exactly 90 degrees.
Rotation – A transformation obtained by rotating a figure around a given point often referred to as a turn.
Symmetry – When an object can be folded in half to form two mirror objects (line symmetry) or when an object can be rotated less than 360 degrees about a point to coincide with an image of the object (rotational symmetry)
Two–Dimensional – A figure that is two-dimensional is one which can be represented on a coordinate grid.

Content Standard 4.0: Spatial Relationships and Geometry

By the end of **Kindergarten**, students know and are able to:	By the end of **Grade 1**, students know and are able to do everything required in the previous grade and:	By the end of **Grade 2**, students know and are able to do everything required in the previous grades and:	By the end of **Grade 3**, students know and are able to do everything required in the previous grades and:	By the end of **Grade 4**, students know and are able to do everything required in the previous grades and:	
4.K.3 Identify two-dimensional figures (e.g., windows are shaped like rectangles) as they appear in the environment.	4.1.3 Identify and replicate two-dimensional designs that contain a **line of symmetry**.	W 4.2.3 Identify figures with symmetry as they appear in the environment; create two-dimensional designs that contain a line of symmetry.			Coordinate Geometry and Line of Symmetry
		I 4.2.4 Identify, name, sort, describe, two- and three-dimensional geometric figures and objects (e.g., circle/sphere, square/cube). S 2.2.1	I/L 4.3.4 Compare, contrast, sketch, model, and build two- and **three-dimensional** geometric figures and objects. S 2.3.1; S 2.3.2; E 1.3.3	4.4.4 Identify, describe, and classify two- and three-dimensional figures by relevant properties including the number of **vertices** (corners), **edges**, and shapes of **faces**, using models.	Two- and three-dimensional figures
					Line, Slopes, and Linear Equations

Edge – The place or line where two sides of a figure meet (the edge of a table).
Face – The shape formed by one of the sides of a three-dimensional figure.
Line of Symmetry – When an object can be folded in half to form two mirror objects.
Pyramid – A three-dimensional figure with a flat base and triangular sides that meet in a point.
Three-Dimensional – A figure like a cube that has length, width, and height.
Vertex – (Plural is vertices.) The point where two sides of a two-dimensional figure meet or the point where two or more edges of a three-dimensional figure meet.

Content Standard 4.0: Spatial Relationships and Geometry

By the end of **Kindergarten**, students know and are able to:	By the end of **Grade 1**, students know and are able to do everything required in the previous grade and:	By the end of **Grade 2**, students know and are able to do everything required in the previous grades and:	By the end of **Grade 3**, students know and are able to do everything required in the previous grades and:	By the end of **Grade 4**, students know and are able to do everything required in the previous grades and:	
				4.4.6 Identify, describe, and draw geometric figures including points, **intersecting lines**, **parallel lines**, **line segments**, **rays**, and angles.	Lines, Angles, and Geometric Figures
					Pythagorean Theorem
					Draw and Construct
					Logic and Deductive

Intersecting Lines – Lines that cross and have exactly one point in common.
Line Segments – Part of a line defined by two endpoints.
Parallel Lines – Lines in the same plane that are always the same distance apart.
Ray – A part of a line that has one endpoint and extends endlessly in one direction

Data Analysis

Content Standard 5.0: *To solve problems, communicate, reason, and make connections within and beyond the field of mathematics, students will collect, organize, display, interpret, and analyze data to determine statistical relationships and probability projections.*

By the end of **Kindergarten,** students know and are able to:	By the end of **Grade 1,** students know and are able to do everything required in the previous grade and:	By the end of **Grade 2,** students know and are able to do everything required in the previous grades and:	By the end of **Grade 3,** students know and are able to do everything required in the previous grades and:	By the end of **Grade 4,** students know and are able to do everything required in the previous grades and:	
5.K.1 Collect and describe data.	5.1.1 Collect, organize, and describe data.	I 5.2.1 Collect, organize, record, and explain classification of data using concrete materials. G 7.2.3; S 21.2.1; S 21.2.2; S 22.2.2; S 24.2.4	I/S 5.3.1 Collect, organize, display, and describe simple data using number lines, **pictographs**, **bar graphs**, and **frequency tables**. E 11.3.4; G 1.3.3; G 4.3.1; G 7.3.3; H 1.3.1; H 1.3.2; S 13.3.2; S 21.3.2; S 22.3.2; S 24.3.4	5.4.1 Collect, organize, display, describe, and interpret simple data using number lines, pictographs, bar graphs, and frequency tables.	Data Collection and Organization
			W/S 5.3.2 Use concepts of **probability** (e.g., impossible, likely, certain) to make predictions about future events.	5.4.2 Conduct simple probability experiments using concrete materials and represent the results using fractions.	Probability
					Probability Analysis
					Central Tendency
					Data Analysis
					Design

Bar Graph – A graph that uses horizontal or vertical bars to represent data.
Frequency Table – A listing of data that includes the number of times an item occurs.
Pictograph – A graph that shows numerical information by using picture symbols.
Probability – The number of favorable outcomes compared to the number of possible outcomes of an experiment.

Problem Solving

Process Standard 6.0: *Students will develop their ability to solve problems by engaging in developmentally appropriate problem solving opportunities in which there is a need to use various approaches to investigate and understand mathematical concepts in order to: formulate their own problems; find solutions to problems from everyday situations; develop and apply strategies to solve a wide variety of problems; and integrate mathematical reasoning, communication and connections.*

Kindergarten	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8	Grade 12
E/S 6.1 Select, modify, develop, and apply strategies to solve a variety of mathematical and practical problems and to investigate and understand mathematical concepts. S 1.2.3; S 1.5.1; S 1.8.1; S 1.8.4; S 1.12.2; S 1.12.4; S 2.12.1; S 3.2.3; S 10.5.2; S 14.8.6; S 19.12.2; S 21.3.1									
E/S 6.2 Apply previous experience and knowledge to new problem-solving situations.									
E 6.3 Formulate (own) problems; use various approaches to investigate and solve problems.									
E/L 6.4 Explain and verify results with respect to the original problem. S 23.2.5; S 23.3.5				E/S 6.5 Verify, interpret, and evaluate results with respect to the original problem situation, determining an efficient strategy for the given situation. S 21.5.3; S 21.12.3					
E/L 6.6 Try more than one strategy when the first strategy proves to be unproductive.									
				E/S 6.7 Apply multi-step, integrated, mathematical problem-solving strategies, persisting until a solution is found or until it is clear that no solution exists. S 19.12.2					
E/L 6.8 Apply solutions and strategies from earlier problems to new problem situations.				E/L 6.9 Generalize solutions and strategies from earlier problems to new problem situations.					
				E/S 6.10 Interpret and solve a variety of mathematical problems by paraphrasing, identifying necessary and extraneous information, selecting and justifying efficient methods and/or strategies, and ensuring the answer is reasonable.					

Process Standard 6.0: Problem Solving

<table>
<tr><th>Kindergarten</th><th>Grade 1</th><th>Grade 2</th><th>Grade 3</th><th>Grade 4</th><th>Grade 5</th><th>Grade 6</th><th>Grade 7</th><th>Grade 8</th><th>Grade 12</th></tr>
<tr><td colspan="9">E/L
6.11
Apply combinations of proven strategies and previous knowledge to solve non-routine problems.</td></tr>
<tr><td colspan="5">I/L
6.12
Use technology, including calculators, to understand quantitative relationships, e.g., for skip counting and pattern exploration.</td><td></td><td></td><td colspan="2"></td></tr>
<tr><td colspan="9">E/L
6.13
Use technology, including calculators, to solve problems and verify solutions.
S 24.5.5; S 24.8.5</td></tr>
<tr><td colspan="9">E/L
6.14
Use technology, including calculators, to investigate, define, and describe quantitative relationships such as patterns and functions.
G 7.12.3; S 1.5.1; S 1.12.2; S 1.12.4; S 14.8.6; S 24.5.5; S 24.8.5</td></tr>
</table>

Mathematical Communication

Process Standard 7.0: *Students will develop their ability to communicate mathematically by solving problems in which there is a need to obtain information from the real world through reading,, listening, and observing in order to: translate this information into a mathematical language and symbols; process this information mathematically; and present results in written, oral and visual formats.*

<table>
<tr><th>Kindergarten</th><th>Grade 1</th><th>Grade 2</th><th>Grade 3</th><th>Grade 4</th><th>Grade 5</th><th>Grade 6</th><th>Grade 7</th><th>Grade 8</th><th>Grade 12</th></tr>
<tr><td colspan="10">E/L
7.1
Discuss and exchange ideas about mathematics as a part of learning.
E 10.2.3; E 10.3.3; E 10.5.3; E 10.3.1; E 10.5.1; E 10.12.1; S 23.5.2</td></tr>
<tr><td colspan="10">E/L
7.2
Use inquiry techniques (e.g. discussion, questioning, research, data gathering) to solve mathematical problems.
E 4.2.3; E 10.2.2; E 10.3.2; E 10.5.2; E 10.8.2; E 11.2.1; E 11.3.1; E 11.5.1; E 11.8.1; E 11.12.1; E 11.2.2; S 1.5.1; S 1.8.1; S 1.8.4; S 1.12.4; S 10.5.2; S 14.8.6; S 21.3.1</td></tr>
<tr><td colspan="6"></td><td colspan="4">I/L
7.3
Read expository text to learn about mathematics.
E 1.8.3; E 1.12.3; E 2.12.3; E 4.8.1; E 4.8.2; E 4.8.3</td></tr>
<tr><td colspan="3">E
7.4
Use pictorial representations to identify mathematical operations and concepts.
S 22.2.2</td><td colspan="3">I/S
7.5
Identify and translate key words and phrases that imply mathematical operations.</td><td colspan="4">E/S
7.6
Interpret and solve word problems without the necessity of key words or phrases.</td></tr>
<tr><td colspan="4">E/S
7.7
Use physical materials, models, pictures, or writing to represent and communicate mathematical ideas.
E 6.3.3; G 1.3.3; G 4.2.1; G 4.2.6; G 4.3.1; G 7.2.5; G 7.3.3; G 7.3.5; G 7.2.3; H 1.3.1; H 1.3.2; S 13.3.2; S 20.3.1; S 21.2.1; S 21.2.2; S 21.3.2; S 22.2.2; S 24.2.4; S 24.3.4</td><td colspan="3">E/S
7.8
Use physical material, diagrams, and tables to represent and then communicate mathematical ideas through oral, verbal, and written formats.
E 11.5.5; G 1.5.4; G 7.5.3; G 7.5.5; H 1.5.1; S 1.5.1; S 20.5.1; S 22.5.2; S 23.5.2</td><td colspan="3">E/S
7.9
Model and explain mathematical relationships using oral, written, graphical, and algebraic methods.
E 5.8.1; E 5.8.2; E 6.8.2; E 11.8.5; E 11.12.5; S 1.12.2; S 1.12.4; S 14.8.6; S 20.12.1; S 22.8.2; S 22.12.2</td></tr>
<tr><td colspan="5"></td><td colspan="5">I/L
7.10
Evaluate the effectiveness of written and oral presentations of mathematics.
S 21.5.3; S 23.5.2</td></tr>
<tr><td colspan="4"></td><td colspan="6">E/L
7.11
Make conjectures and present arguments in discussions of mathematical ideas.
E 8.12.2; S 21.12.3</td></tr>
<tr><td colspan="6">W/L
7.12
Explain and justify thinking about mathematical ideas and solutions. E 8.8.2; E 8.12.2; S 19.8.1</td><td colspan="4"></td></tr>
</table>

Conjecture – An idea or theory that has not been proved.

Diagram – A drawing or graphical representation used to illustrate mathematical relationships.

Process Standard 7.0: Mathematical Communication

Kindergarten	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8	Grade 12
						I/L 7.13 Explain and evaluate thinking about mathematical ideas and solutions. E 10.8.2; E 10.12.4; S 21.5.3		I 7.14 Explain and evaluate thinking about mathematical ideas and solutions based on the role of definitions, properties, common rules, and symbols in solving problems.	
E/L 7.15 Use everyday language to explain thinking about strategies and solutions to mathematical problems. S 21.5.3; S 23.5.2									
E/S 7.16 Express mathematical ideas and use them to define, compare, and solve problems orally and in writing.									
E/L 7.17 Use mathematical notation to communicate and explain mathematical situations. S 21.2.1									

Mathematical Reasoning

Process Standard 8.0: *Student will develop their ability to reason mathematically by solving problems in which there is a need to investigate significant mathematical ideas and* ***construct*** *their own learning in all content areas in order to justify their thinking; reinforce and extend their logical reasoning abilities; reflect on and clarify their own thinking; and ask questions to extend their thinking.*

<table>
<tr><th>Kindergarten</th><th>Grade 1</th><th>Grade 2</th><th>Grade 3</th><th>Grade 4</th><th>Grade 5</th><th>Grade 6</th><th>Grade 7</th><th>Grade 8</th><th>Grade 12</th></tr>
<tr><td colspan="4">I/L
8.1
Justify and explain the solutions to problems using manipulative and physical models.
S 3.2.3; S 20.3.2</td><td colspan="3">E/S
8.2
Justify answers and the steps taken to solve problems, with and without manipulatives, and physical models.
S 1.5.1; S 10.5.2; S 20.5.1</td><td colspan="2">I/L
8.3
Construct, justify, and defend mathematical conclusions using logical arguments, in situations related to mathematics, science, and technology.
E 10.12.4; G 7.12.4; S 1.8.1; S 1.8.4; S 1.12.4; S 14.8.6</td></tr>
<tr><td colspan="10">E/S
8.4
Use patterns and relationships to analyze mathematical situations; draw logical conclusions about mathematical problems.
Ec 3.8.2; Ec 3.8.3; Ec 9.8.4; Ec 3.12.1; Ec 3.12.2; Ec 3.12.3; Ec 3.12.4; Ec 6.12.6; G 7.12.4; S 17.3.2</td></tr>
<tr><td colspan="4"></td><td colspan="6">E/L
8.5
Follow a logical argument and judge its validity.
E 4.8.4; E 4.12.4</td></tr>
<tr><td colspan="4"></td><td colspan="3">E/S
8.6
Apply deductive and inductive reasoning in mathematical situations to extend logical reasoning.
Ec 3.12.3</td><td colspan="3">E/S
8.7
Recognize and apply deductive and inductive reasoning in both concrete and abstract contexts.</td></tr>
<tr><td colspan="10">E/L
8.8
Ask questions to reflect on, clarify, and extend thinking.</td></tr>
<tr><td colspan="10">I/L
8.9
Review and refine the assumptions and steps used to derive conclusions in mathematical arguments.</td></tr>
</table>

Process Standard 8.0: Mathematical Reasoning

Kindergarten	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8	Grade 12
								I/L 8.10 Construct valid arguments; make and test conjectures about algebraic and geometric properties based on mathematical principles. E 10.12.4	
E/S 8.11 Determine relevant, irrelevant, and/or sufficient information to solve mathematical problems.									

Mathematical Connections

Process Standard 9.0: *Students will develop the ability to make mathematical connections by solving problems in which there is a need to view mathematics as an integrated whole, identifying relationships between context strands, and integrating mathematics with other disciplines, allowing the flexibility to approach problems in a variety of ways within and beyond the field of mathematics.*

<table>
<tr><th>Kindergarten</th><th>Grade 1</th><th>Grade 2</th><th>Grade 3</th><th>Grade 4</th><th>Grade 5</th><th>Grade 6</th><th>Grade 7</th><th>Grade 8</th><th>Grade 12</th></tr>
<tr><td colspan="10">E/L
9.1
Link new concepts to prior knowledge.</td></tr>
<tr><td></td><td colspan="9">E/S
9.2
Use mathematical ideas from one area of mathematics to explain an idea from another area of mathematics.</td></tr>
<tr><td colspan="4"></td><td colspan="6">E/S
9.3
Use models to explain the relationship of concepts to procedures.
S 1.5.1; S 1.8.1; S 1.12.2; S 1.8.4; S 1.12.4; S 10.5.2; S 14.8.6; S 20.5.1</td></tr>
<tr><td colspan="6"></td><td colspan="4">I/L
9.4
Use the connections among mathematical topics to develop multiple approaches to problems.
S 20.8.1</td></tr>
<tr><td colspan="6">I/L
9.5
Identify practical applications of mathematical principles that can be applied to other disciplines.

S 14.12.5</td><td colspan="4">I/L
9.6
Use and analyze the connections between Mathematics and other disciplines.
Ec 2.8.2; Ec 2.12.4; Ec 2.12.8; H 2.8.3; H 2.12.3; S 2.12.1; S 14.12.5</td></tr>
<tr><td colspan="10">E/L
9.7
Apply mathematical thinking and modeling to solve problems that arise in other disciplines (e.g. rhythm in music and motion in science).
S 1.5.1; S 1.8.1; S 1.12.2; S 1.8.4; S 1.12.4; S 10.5.2; S 14.8.6; S 19.12.2</td></tr>
<tr><td colspan="10">I/S
9.8
Identify, explain, and use mathematics in everyday life.
Ec 2.3.2; Ec 2.12.12; Ec 5.2.1; Ec 5.3.1; S 24.12.2</td></tr>
</table>

Numbers, Number Sense, and Computation

Content Standard 1.0: *To solve problems, communicate, reason, and make connections within and beyond the field of mathematics, students will accurately calculate, use estimation techniques, number relationships, operation rules, and algorithms; they will determine the reasonableness of answers and the accuracy of solutions.*

By the end of **Grade 5,** students know and are able to do everything required in previous grades and:	By the end of **Grade 6,** students know and are able to do everything required in the previous grades and:	By the end of **Grade 7,** students know and are able to do everything required in the previous grades and:	By the end of **Grade 8,** students know and are able to do everything required in the previous grades and:	By the end of **Grade 12,** students know and are able to do everything required in the previous grades and:	
E/S 1.5.1 Use and apply multiplication and corresponding division facts through 12's.	1.6.1 Read, write, add, subtract, multiply, and divide using decimals, fractions, and percents.	1.7.1 Read, write, and compute **ratios**[2] and **proportions**; read, write, add, subtract, multiply, and divide positive and negative numbers.	I/S 1.8.1 Read, write, add, subtract, multiply, and divide **real numbers** in various forms including **radicals**, exponential, and **scientific notation**. Ec 2.8.2; Ec 9.8.4; H 3.8.4	I/S 1.12.1 **Calculate** and estimate sums, differences, products, quotients, **powers**, and **roots** using mental math, **formulas**, and **algorithms**. S 23.12.3; C 4.12.1	Facts

Algorithm – A rule or procedure used to complete an exercise or solve a problem.
Calculate – (Compute) The process of adding, subtracting, multiplying, dividing, or finding the square root.
Formula – An equation that states a fact or rule (lw = A).
Powers – A term that is used to describe an exponent. For example, the expression 3^4 can be read as 3 to the fourth power.
Proportions - An equation that represents the equality of two ratios.
Radicals – A term used to refer to roots of numbers such as the cube root of 5.
Ratio – A comparison of two quantities or a rate of change.
Real Numbers – The rational numbers and the irrational numbers.
Root – A number that can be used as a factor a given number of times to produce the original number (i.e., the fifth root of 32 is 2 because 2 x 2 x 2 x 2 x 2 = 32).
Scientific Notation – A method of representing a number as a product of a number between 0 and 10 and a power of ten. For example, 3456 can be written as 3.456×10^3.

[2] Words in bold text are defined at the bottom of the page.

Content Standard 1.0: Numbers, Number Sense, and Computation

By the end of **Grade 5**, students know and are able to do everything required in previous grades and:	By the end of **Grade 6**, students know and are able to do everything required in the previous grades and:	By the end of **Grade 7**, students know and are able to do everything required in the previous grades and:	By the end of **Grade 8**, students know and are able to do everything required in the previous grades and:	By the end of **Grade 12**, students know and are able to do everything required in the previous grades and:	
E/S 1.5.2 Generate and solve addition, subtraction, multiplication, and division problems using whole numbers in practical situations. Ec 2.5.2; Ec 9.5.4	1.6.2 Apply decimals, fractions, and percents to solve mathematical and practical problems.	1.7.2 Apply positive and negative numbers, ratios, and proportions to solve mathematical and practical problems.	E/S 1.8.2 Compute with **rational** and **irrational numbers** to solve a variety of problems including rates, recipes, unit costs, and percents (e.g., discounts, interest, sale, prices, commissions, taxes). Ec 9.8.4	W/L 1.12.2 Apply the laws of **exponents** to perform **operations** on expressions with **integral exponents** and expressions in scientific notation. S 1.12.2	Application
E/S 1.5.3 Use **order of operations** to solve problems.	1.6.3 Use the concepts of **number theory**, including **prime** and **composite numbers**, factors, **multiples**, and the rules of divisibility.	1.7.3 Use **absolute value** and the properties of real numbers including distributive, **commutative**, and **associative** to solve problems.	I/L 1.8.3 Explain and apply number theory and the properties of real numbers to solve problems. H 3.8.4	I/S 1.12.3 Apply the properties and theories of the real number system to everyday situations. S 1.12.2; H 3.12.4	Word Problems and Number Theory

Absolute Value – A number's distance from zero on a number line. The absolute value of 2 is equal to the absolute value of –2.
Associative - The property which states that the manner of grouping three or more numbers when added or multiplied does not change the answer (e.g., 2+(3+5) = (2+3)+5).
Commutative - The order in which two numbers are added or multiplied does not change the sum.
Composite Number - A whole number that is the result of at least two numbers (with "1" not one of the numbers) being multiplied together and that can be broken down into factors (20 = 2 • 10).
Exponent – A term that is used to describe the power to which a number or variable is raised. For example, in the expression 3^4, the 4 is referred to as the exponent.
Integral Exponent – An exponent that is a whole number or its opposite. For example, x^4 or y^{-4} have integral exponents, respectively of 4 and –4.
Irrational Numbers – Numbers which have infinite, but non-repeating, decimal representations.
Multiple – A multiple of a number is the product of that number and any whole. For example, 24 is a multiple of 6.
Number Theory – The exploration of properties and characteristics of numbers.
Operation – A term most commonly used to refer to addition, subtraction, multiplication, or division but may also refer to, for example, taking a square root, cubing a number, and intersecting sets.
Order of Operation – A rule used to provide conformity in the results of a string of operations. For example, 3+5x4-2 should be interpreted as equal to 21 because the order of operations requires that we multiply and divide before we add and subtract.
Prime Number – A whole number greater than 1 that has only 1 and itself as factors. For example, 13 is a prime number, 10 is not a prime number.
Rational Number – A number that can be written in the form of a fraction.

Content Standard 1.0: Numbers, Number Sense, and Computation

By the end of **Grade 5**, students know and are able to do everything required in previous grades and:	By the end of **Grade 6**, students know and are able to do everything required in the previous grades and:	By the end of **Grade 7**, students know and are able to do everything required in the previous grades and:	By the end of **Grade 8**, students know and are able to do everything required in the previous grades and:	By the end of **Grade 12**, students know and are able to do everything required in the previous grades and:	
1.5.4 Add and subtract decimals; multiply and divide decimals by whole numbers in problems representing practical situations.					Decimals
E/S 1.5.5 Multiply and divide multi-digit numbers by 2-digit numbers, including strategies for powers of 10.	see 1.6.1	see 1.7.1	see 1.8.1	W/L 1.12.5 Perform simple operations on **matrices**.	Computation
I/L 1.5.6 Compare and order negative numbers within the context of everyday happenings (e.g., temperature) and plot those numbers on a number line.	1.6.6 Compare and order groups of fractions and groups of decimals (e.g., on a number line).	1.7.6 Compare and order groups containing a mix of fractions, percents, and decimals (e.g., on a number line).	1.8.6 Compare and order rational numbers.		Comparison and Ordering

Matrices - Plural of matrix. A way of displaying information in an array. For example, the expression $3x^2 + 4x + 2$ can be displayed in a matrix form as [3 4 2].

Content Standard 1.0: Numbers, Number Sense, and Computation

By the end of **Grade 5**, students know and are able to do everything required in previous grades and:	By the end of **Grade 6**, students know and are able to do everything required in the previous grades and:	By the end of **Grade 7**, students know and are able to do everything required in the previous grades and:	By the end of **Grade 8**, students know and are able to do everything required in the previous grades and:	By the end of **Grade 12**, students know and are able to do everything required in the previous grades and:	
I/L 1.5.7 When **rounding**, identify which place value will be most helpful in estimating an answer and determine the reasonableness of the answer.	1.6.7 Round to a given decimal place value; estimate using decimals, fractions, and percents.	1.7.7 Select and round to the appropriate significant digit; estimate using a variety of methods.	E/S 1.8.7 Estimate in problem-solving situations and in practical applications; determine the reasonableness of the answer and verify the results.		Estimation and Rounding
E/S 1.5.8 Use and identify place value.					Place value
E/S 1.5.9 Use models and drawings to identify, compare, add, and subtract fractions with like denominators and to add and subtract decimals; use both to solve problems.	1.6.9 Use models and drawings to identify, compare, add, and subtract fractions with unlike denominators; use models to translate among fractions, decimals, and percents.	1.7.9 Translate among fractions, decimals and percents.	E/S 1.8.9 Explain the relationship among fractions, decimals, and percents; translate among various representations of equal numbers (e.g., from fractions to decimals to percents, various forms of "1" such as 3/3 or 16/16) to solve problems efficiently.		Fractions

Rounding Numbers – Expressing a number to the nearest one, nearest ten, nearest hundred and so on.

Patterns, Functions, and Algebra

Content Standard 2.0: *To solve problems, communicate, reason, and make connections within and beyond the field of mathematics, students will use various algebraic methods to analyze, illustrate, extend, and create numerous representations (words, numbers, tables, and graphs) of patterns, functions, and algebraic relations as modeled in practical situations.*

By the end of **Grade 5,** students know and are able to do everything required in previous grades and:	By the end of **Grade 6,** students know and are able to do everything required in the previous grades and:	By the end of **Grade 7,** students know and are able to do everything required in the previous grades and:	By the end of **Grade 8,** students know and are able to do everything required in the previous grades and:	By the end of **Grade 12,** students know and are able to do everything required in the previous grades and:	
E/L 2.5.1 Identify, describe, and explain patterns and relationships in the number system (e.g., formed by **triangular numbers**, perfect squares, arithmetic and **geometric sequences**) using concrete materials, paper and pencil, and calculators.	2.6.1 Use and create tables and charts to extend a **pattern** in order to describe a rule.	2.7.1 Use and create coordinate graphs (i.e., linear, geometric, and exponential) to represent and/or interpret patterns and relationships, with and without calculators.	E/S 2.8.1 Use **inductive reasoning** to find the missing term in number and geometric patterns and to generalize basic patterns to the nth term, with and without calculators; use written, oral, and **symbolic language** to identify and describe patterns, **sequences**, and **functions**.		Patterns

Function – An association of one object (or number) from one group or collection with one and only one object of another group or collection. This association is often represented in words, graphically, or algebraically.

Geometric Sequence – A sequence of numbers in which the next term can by found by multiplying the current term by some number (given the initial term 3 and a multiplier of 2 yields the geometric sequence of 3, 6, 12, 24…).

Inductive Reasoning – A particular type of logic which involves drawing conclusions from several specific, known facts and using them to make generalizations about other, similar situations.

Sequence – A series of numbers that are predictable and can be extended using simple addition or subtraction (4, 7, 10, 13…).

Symbolic Language – Mathematical ideas expressed in a symbol or group of symbols.

Triangular Numbers – The numbers 1,3,6,10....are triangular because they can be expressed by employing the number of dots in successive triangular arrays of dots (this can be thought of as "stair-step numbers" or 1, 1+2, 1+2+3, 1+2+3+4, …).

Content Standard 2.0: Patterns, Functions, and Algebra

By the end of **Grade 5**, students know and are able to do everything required in previous grades and:	By the end of **Grade 6**, students know and are able to do everything required in the previous grades and:	By the end of **Grade 7**, students know and are able to do everything required in the previous grades and:	By the end of **Grade 8**, students know and are able to do everything required in the previous grades and:	By the end of **Grade 12**, students know and are able to do everything required in the previous grades and:	
	2.6.2 Identify, model, describe, and evaluate relationships using charts and tables, with and without technology.	2.7.2 Identify, model, describe, and evaluate relationships using graphs, with and without technology.	E/L 2.8.2 Translate among verbal descriptions, graphic, tabular, and algebraic representations of mathematical situations. Ec 3.8.2; S 1.8.1; S 1.8.4; S 14.8.6; S 20.8.2	E/L 2.12.2 Represent and solve problems using **discrete** structures including graphs and matrices, with and without technology. Ec 3.12.2; H 4.12.1; H 5.12.1	Relationships
W/S 2.5.3 Using whole numbers as a replacement set, find possible solutions to such inequalities as 8 + 4 > n.		2.7.3 Evaluate formulas and algebraic expressions for given values of a variable (e.g., A = lw given l = 6, w = 2, then A = 12).	I/S 2.8.3 Identify, model, describe, and evaluate relationships, including functions, using a variety of methods with and without technology.	E/S 2.12.3 Create and use different forms of a variety of equations, proportions, and/or formulas (e.g., I=PRT or R=I/PT), solving for the needed variable as necessary in given situations. H 3.12.4; H 4.12.1; S 1.12.2; S 1.12.4; S 20.12.1; S 23.12.2	Variables (Unknowns)

Discrete Graph – A graph that has discontinuous information that results in breaks in the display (the graph shows the temperatures only for weekdays and not for weekends).

Content Standard 2.0: Patterns, Functions and Algebra

By the end of **Grade 5**, students know and are able to do everything required in previous grades and:	By the end of **Grade 6**, students know and are able to do everything required in the previous grades and:	By the end of **Grade 7**, students know and are able to do everything required in the previous grades and:	By the end of **Grade 8**, students know and are able to do everything required in the previous grades and:	By the end of **Grade 12**, students know and are able to do everything required in the previous grades and:	
E/S 2.5.4 Use variables in open sentences and to describe simple functions and relationships.		I/S 2.7.4 Represent mathematical situations using algebraic language and symbols	I/S 2.8.4 Add and subtract **binomials**; describe the connection between the algebraic process and the arithmetic process.	I/S 2.12.4 Add, subtract, multiply, and factor (1st and 2nd degree) **polynomials**, describing each step in the process and the connection between the algebraic process and the arithmetic process; use simple quadratic equations with integer roots to solve practical and mathematical problems. H 3.12.4; H 4.12.1; S 23.12.2	Number Sentences and Equations
W/S 2.5.5 Generate number sequences given the first term and any basic computation rule (e.g., given a 4 and the rule of add 6, 10, 16, 22, 28, ...).		2.7.5 Combine like terms variable expressions (e.g., 2a+3a=5a).	I/S 2.8.5 Describe how a change in one variable of a mathematical relationship affects the remaining variables using various tools and methods. Ec 3.8.2; Ec 3.8.3; H 3.8.4	E/S 2.12.5 Model practical problems from everyday situations with a variety of models that includes matrices, translating among tabular, symbolic and graphical representations of functions, with and without technology. Ec 3.12.2; Ec3.12.3; Ec 3.12.4; Ec 6.12.6 G 1.12.3; H 3.12.4; H 4.12.1; S 1.12.2	Algebraic Basics

Binomials - Algebraic expressions that can be represented by exactly two unlike terms when simplified, i.e., (2x + 3y).
Polynomials - Algebraic expressions that can be represented by two or more unlike terms when simplified (i.e., $5x + 2y + 3z$).

Content Standard 2.0: Patterns, Functions and Algebra

By the end of **Grade 5**, students know and are able to do everything required in previous grades and:	By the end of **Grade 6**, students know and are able to do everything required in the previous grades and:	By the end of **Grade 7**, students know and are able to do everything required in the previous grades and:	By the end of **Grade 8**, students know and are able to do everything required in the previous grades and:	By the end of **Grade 12**, students know and are able to do everything required in the previous grades and:	
		E/S 2.7.6 Model, identify, and solve **linear equations** and inequalities using concrete and informal methods; relate this process to the order of operations.	E/S 2.8.6 Model, identify, and solve linear equations and inequalities; relate this process to the order of operations. H 3.8.4	W/L 2.12.6 Determine the **domain** and **range** of linear relations given a graph or a set of **ordered pairs**; explain their importance in problem solving situations. H 5.12.1	Linear Equations
E/L 2.5.7 Solve simple equations using a variety of methods (e.g. **inverse operations**, mental math, and estimate and verify).	2.6.7 Use a rule to create a table and represent the ordered pairs on a **coordinate grid**.	2.7.7 Generate and graph a set of ordered pairs to solve a linear equation	I/S 2.8.7 Solve simple linear equations and connect that process to the order of operations. H 3.8.4	W/L 2.12.7 Solve systems of two linear equations, both algebraically and graphically; use graphing calculators as a primary tool in solving these problems and to verify solutions found by other methods.	Equation Solutions

Coordinate Grid – A (two-dimensional) flat surface formed by two intersecting number lines, one horizontal and one vertical, which can be used to name any point on the surface by an ordered pair of numbers.
Domain – A collection of potential values to be used in place of the variable in a mathematical sentence describing a relationship.
Inverse Operations – Two operations that undo each other (i.e., addition and subtraction).
Linear Equations - An algebraic equation that describes a straight line.
Ordered Pair – A pair of numbers that gives the location of a point on a coordinate grid. The first number in the ordered pair describes the horizontal reference and the second describes the vertical.
Range – The solutions determined by evaluating a mathematical sentence using its domain.

Measurement

Content Standard 3.0: *To solve problems, communicate, reason, and make connections within and beyond the field of mathematics, students will use appropriate tools and techniques of measurement to determine, estimate, record, and verify direct and indirect measurements.*

By the end of **Grade 5**, students know and are able to do everything required in previous grades and:	By the end of **Grade 6**, students know and are able to do everything required in the previous grades and:	By the end of **Grade 7**, students know and are able to do everything required in the previous grades and:	By the end of **Grade 8**, students know and are able to do everything required in the previous grades and:	By the end of **Grade 12**, students know and are able to do everything required in the previous grades and:	
	3.6.1 Estimate and convert, units of measure for length, weight, and **capacity**, within the same measurement system (customary or metric).	3.7.1 Estimate and convert, units of measure for **mass**, and volume within the same measurement system; compare corresponding units of the two systems.		I/L 3.12.1 Convert between customary and metric systems; convert among monetary systems.	Comparison and Ordering
	3.6.2 Explain how the size of the unit used affects the **precision**; given two measurements of the same object, select the one that is more precise.	3.7.2 Given a measurement, determine the **greatest possible error**.	I/S 3.8.2 Demonstrate an understanding of precision, error, and **tolerance** in measurement using the appropriate measurement tool to the required degree of accuracy. S 23.8.5	I/S 3.12.2 Select and use measurement tools, techniques, and formulas to calculate and compare rates, cost, distances, interest, temperatures, and weight/mass. S 2.12.1	Measurement

Capacity – The maximum amount of liquid a container can hold.

Greatest Possible Error – The measurement error which results from rounding or estimating a measurement to the nearest specified unit of measure.

Mass – The measure of the amount of matter of an object in the object's mass while an object's weight is a measure of the force with which gravity attracts the object. Although you mass is the same on Earth as it is on the Moon, you weigh more on Earth because the attraction of gravity is greater on Earth.

Precision of Measurement – Precision of measurement tells how finely a measurement is made. The size of the units determines the precision. The smaller the unit, the more precise the measurement.

Tolerance - The allowable error in a given measurement. If a part has a given measure of 5.125" – the error allowable when making the pat may be 0.005" more or less than the actual measure of 5.125". The standard way of writing the tolerance allowed is 5.125 +/- 0.005:, which means that any measure between 5.120" and 5.130" would be acceptable.

Content Standard 3.0: Measurement

By the end of **Grade 5**, students know and are able to do everything required in previous grades and:	By the end of **Grade 6**, students know and are able to do everything required in the previous grades and:	By the end of **Grade 7**, students know and are able to do everything required in the previous grades and:	By the end of **Grade 8**, students know and are able to do everything required in the previous grades and:	By the end of **Grade 12**, students know and are able to do everything required in the previous grades and:	
E/S 3.5.3 Estimate measures of length, volume, capacity, quantity, and weight, communicating degree of accuracy needed and when a more precise measure is required. S 23.5.3	3.6.3 Estimate, measure to the required degree of accuracy, derive, and apply formulas to find the perimeter, circumference, and **area** of **plane figures**.	3.7.3 Estimate, measure to the required degree of accuracy, derive, and apply standard formulas to find the volume and surface area of solid figures (e.g., **cylinders**, triangular solids).	E/S 3.8.3 Select and apply appropriate formulas to solve problems; identify the relationship between changes in area and volume and changes in linear measures of figures.	I/S 3.12.3 Distinguish and differentiate among the structures, language and uses of systems of measures (e.g., linear, square units, cubic units); justify and communicate the differences between accuracy, precision, error, and tolerance in measurement; describe how each of these can affect solutions found in problem situations. S 23.12.8	Estimation and formulas
E/S 3.5.4 Determine totals and change due for monetary amounts in problem-solving situations.				I/L 3.12.4 Use and interpret consumer data (e.g., **amortization tables**, tax tables, and compound interest charts) to make informed financial decisions related to practical applications such as budget. E 4.12.3; Ec 2.12.4; Ec 2.12.5; Ec 2.12.8; Ec 2.12.12	Money

Amortization Table – A table used to display monthly payment costs (principal + interest) based on loan interest rate and the amount of time that will be used to repay the loan.
Area – The size of a region measured in number of square units (i.e., inches squared, square feet).
Cylinder – A three-dimensional figure shaped like a soup can.
Plane Figures – A two-dimensional region.

Content Standard 3.0: Measurement

By the end of **Grade 5**, students know and are able to do everything required in previous grades and:	By the end of **Grade 6**, students know and are able to do everything required in the previous grades and:	By the end of **Grade 7**, students know and are able to do everything required in the previous grades and:	By the end of **Grade 8**, students know and are able to do everything required in the previous grades and:	By the end of **Grade 12**, students know and are able to do everything required in the previous grades and:	
I/S 3.5.5 Communicate the difference between perimeter and area.	3.6.5 Use ratios to describe and compare relationships between various objects.	3.7.5 Write, solve, and apply proportions.	E/S 3.8.5 Apply ratios and proportions to calculate rates and as a method of **indirect measure** (e.g., miles per hour, cost per unit). Ec 2.8.2; S 23.8.1	I/S 3.12.5 Use relationships (e.g., proportions) and formulas (indirect measurement) to determine the measurement of unknown dimensions, angles, areas, and volumes to solve problems. S 2.12.1; S 23.12.4	Proportion and Ratio
E/S 3.5.6 Identify equivalent periods of time, including relationships between and among seconds, minutes, hours, days, months, and years (e.g, 60 sec = 1 min).		3.7.6 Use elapsed time to solve practical problems (e.g., develop schedules, plan trips).			Time

Indirect Measure – A measure found by using a formula or other strategy and not actually measuring something (i.e., finding the height of a tree without actually holding a ruler next to it).

Spatial Relationships and Geometry

Content Standard 4.0: *To solve problems, communicate, reason, and make connections within and beyond the field of mathematics, students will identify, represent, explain, verify, and apply spatial relationships and geometric properties.*

By the end of **Grade 5,** students know and are able to do everything required in previous grades and:	By the end of **Grade 6,** students know and are able to do everything required in the previous grades and:	By the end of **Grade 7,** students know and are able to do everything required in the previous grades and:	By the end of **Grade 8,** students know and are able to do everything required in the previous grades and:	By the end of **Grade 12,** students know and are able to do everything required in the previous grades and:	
I/S 4.5.1 Draw and classify triangles, according to their properties; (e.g., right, scalene, obtuse, equilateral); identify and draw circles and parts of circles, describing the relationships between the various parts (e.g., central angle, **arc**, diameter)	4.6.1 Measure angles; identify, describe by properties, classify, compare, and draw regular and irregular quadrilaterals; find the sum of the interior angles of triangles and quadrilaterals.	4.7.1 Identify, describe by properties, classify, compare, and draw regular and irregular polygons; find the sum of the interior angles.		I/S 4.12.1 Identify and use the properties of polygons (including interior and exterior angles) and elements of circles (e.g., angles, arcs, **chords**, **secants** and **tangents**) to solve practical problems. H 3.12.4	Two - Dimensional Shapes

Arc – A connected portion of a circle.
Chord – A straight line segment that connects two sides of a circle, but does not go through the exact center.
Secant –A straight line intersecting the circle at two points.
Tangent –A straight line intersecting the circle at exactly one point.

Content Standard 4.0: Spatial Relationships and Geometry

By the end of **Grade 5**, students know and are able to do everything required in previous grades and:	By the end of **Grade 6**, students know and are able to do everything required in the previous grades and:	By the end of **Grade 7**, students know and are able to do everything required in the previous grades and:	By the end of **Grade 8**, students know and are able to do everything required in the previous grades and:	By the end of **Grade 12**, students know and are able to do everything required in the previous grades and:	
I/S 4.5.2 Identify shapes that have congruence, similarity, and/or symmetry of figures using a variety of methods including transformational motions (e.g., **translation**/slide, rotation/turn, **reflection**/flip, enlargement/reduction) and models, drawings, and measurement tools.	4.6.2 Determine actual measurements represented on scale drawings (e.g., maps, blueprints, houseplans).	4.7.2 Use ratio and proportions to create scale drawings.	E/S 4.8.2 Apply the properties of equality and proportionality to solve problems involving congruent or similar shapes. H 3.8.4		Congruence, Similarity, and Transformations

Reflection – The mirror image of a figure often referred to as a flip.
Translation – Changing the position of an object by sliding it in any direction without rotation or reflection. Translations are often referred to as slides.

Content Standard 4.0: Spatial Relationships and Geometry

By the end of **Grade 5**, students know and are able to do everything required in previous grades and:	By the end of **Grade 6**, students know and are able to do everything required in the previous grades and:	By the end of **Grade 7**, students know and are able to do everything required in the previous grades and:	By the end of **Grade 8**, students know and are able to do everything required in the previous grades and:	By the end of **Grade 12**, students know and are able to do everything required in the previous grades and:	
E/S 4.5.3 Using a grid, identify coordinates for a given point or locate points of given coordinates in the first **quadrant**. G 1.5.1	4.6.3 Using a coordinate grid, identify coordinates for a given point and locate points of given coordinates; plot geometric shapes in all four quadrants.	4.7.3 Use coordinate geometry and models to demonstrate geometric transformations including rotate/turn, translate/slide, reflect/flip by finding the ordered pairs that describe the location of the original and the transformed figures.	W/L 4.8.3 Use coordinate geometry and models to change scale (enlarge and reduce).		Coordinate Geometry and Line of Symmetry
E/S 4.5.4 Identify, describe, compare, and classify two and three-dimensional figures by relevant properties including number of vertices (corners), **edges**, and shapes of faces; identify and predict the effects of combining, dividing, and changing shapes into other shapes.	4.6.4 Make a model of a three dimensional **prism** from a **two-dimensional** drawing and make a two-dimensional drawing of a three-dimensional prism.	4.7.4 Make a model of a **three-dimensional** figure from a two-dimensional drawing and make a two-dimensional drawing of a three dimensional object			Two and Three Dimensional Figures

Edge – The place or line where two sides of a figure meet (the edge of a table).
Prism – A three-dimensional figure with two opposite bases that are identical polygons and faces that are parallelograms.
Quadrant – Labels for the four regions formed by the axes of a coordinate grid. The first quadrant is the region which includes only positive ordered pairs.
Three-Dimensional – A figure that is three-dimensional is one which has length, height.
Two-Dimensional – A flat figure like a piece of paper. It has length and width, but not height.

Content Standard 4.0: Spatial Relationships and Geometry

By the end of **Grade 5**, students know and are able to do everything required in previous grades and:	By the end of **Grade 6**, students know and are able to do everything required in the previous grades and:	By the end of **Grade 7**, students know and are able to do everything required in the previous grades and:	By the end of **Grade 8**, students know and are able to do everything required in the previous grades and:	By the end of **Grade 12**, students know and are able to do everything required in the previous grades and:	
	4.6.5 Model **slope** (pitch, **angle of inclination**) using concrete objects and practical examples.	4.7.5 Use coordinate geometry to represent slope, midpoint, and horizontal and vertical distance.	I/L 4.8.5 Use coordinate geometry to represent and interpret relationships defined by equations and formulas (including distance, midpoint, and slope), with and without technology.	I/S 4.12.5 Use coordinate geometry to graph linear equations, determine slopes of lines, identify parallel and **perpendicular lines** and find possible solutions to sets of equations; use algebraic techniques to solve problems determined by geometric relationships. H 5.12.1	Line, Slopes, and Linear Equations
E/S 4.5.6 Identify, describe, define, and draw geometric figures including points, intersecting, perpendicular and parallel lines, line segments, rays, angles, and planes.	4.6.6 Draw **complementary** and **supplementary angles**; identify and find measures of complementary and supplementary angles using arithmetic and geometric methods.	4.7.6 Describe the properties of geometric relationships including parallel lines, perpendicular lines, bisectors, triangles, and quadrilaterals (e.g., properties of angles formed by a **transversal** of parallel lines).	I/S 4.8.6 Form generalizations and **validate** conclusions about properties of geometric shapes including parallel lines, perpendicular lines, bisectors, triangles, and quadrilaterals. H 3.8.4	W/S 4.12.6 Use complementary and supplementary angles, congruent angles, vertical angles, angles formed when parallel lines are cut by a transversal, and angles in polygons to solve practical problems. H 3.12.4	Lines, Angles, and Geometric Figures

Angle of Inclination – The positive angle, less than 180 degrees, that measures the steepness of the slope.
Complementary Angles – Two angles whose measures total exactly 90 degrees.
Perpendicular Lines – Two lines that intersect to form right angles.
Slope – The degree of steepness of a line (or curve) as measured by pitch or rise over run.
Supplementary Angles – Two angles whose measures total exactly 180 degrees.
Transversal - The name given to a line that intersects two or more other lines in a given plane.
Validate – To give evidence that a solution or process is correct.

Content Standard 4.0: Spatial Relationships and Geometry

By the end of Grade 5, students know and are able to do everything required in previous grades and:	By the end of Grade 6, students know and are able to do everything required in the previous grades and:	By the end of Grade 7, students know and are able to do everything required in the previous grades and:	By the end of Grade 8, students know and are able to do everything required in the previous grades and:	By the end of Grade 12, students know and are able to do everything required in the previous grades and:	
	4.6.7 Determine the measures of missing angles of triangles based on the **Triangle Sum Theorem** (the sum of the interior angles of a triangle equals 180 degrees).	4.7.7 Model the **Pythagorean Theorem**; solve for the **hypotenuse** using the theorem.	I/S 4.8.7 Verify and explain the Pythagorean Theorem using various methods (e.g., using grid paper, applying it to a missing side of a **right triangle**); determine missing sides and angles of triangles based on properties of their sides and angles. H 3.8.4	I/S 4.12.7 Apply the Pythagorean Theorem, its **converse**, properties of special right triangles, and right triangle trigonometry to solve practical problems. H 3.12.4	Pythagorean Theorem
	4.6.8 Construct circles, angles, and triangles based on given measurements using a variety of methods (e.g., protractor, paper folding).	4.7.8 Construct and verify congruent angles, and parallel and perpendicular lines using hand tools.	W/L 4.8.8 Use hand tools, technology, and models to construct figures and bisect angles and line segments; distinguish among **constructions**, sketches and drawings.	W/L 4.12.8 Use tools, technology, and models to sketch, draw, and construct geometric figures in order to solve problems and to demonstrate the properties of geometric figures.	Draw and Construct

Construction – The process of creating a figure or diagram, usually with a compass and straightedge, which will satisfy given conditions which describe it. Two axioms are necessary for all constructions (1) one and only one straight line may be drawn between two points and (2) with any given point as the center and any given distance as the radius, a circle may be drawn.

Converse of the Pythagorean Theorem – If the square of one of the sides of a triangle is equal to the sum of the squares of the other two sides of a triangle, then the triangle is a right triangle.

Hypotenuse – The side of a right (90 degree) triangle that is across from the right angle.

Pythagorean Theorem – If a triangle is a right triangle, then the square of the length of one leg added to the square of the length of the other leg is equal to the square of the hypotenuse.

Right Triangles – A triangle in which one angle is equal to 90 degrees.

Triangle Sum Theorem – The sum of the interior angles of any triangle is equal to 180 degrees.

Content Standard 4.0: Spatial Relationships and Geometry

By the end of **Grade 5,** students know and are able to do everything required in previous grades and:	By the end of **Grade 6,** students know and are able to do everything required in the previous grades and:	By the end of **Grade 7,** students know and are able to do everything required in the previous grades and:	By the end of **Grade 8,** students know and are able to do everything required in the previous grades and:	By the end of **Grade 12,** students know and are able to do everything required in the previous grades and:	
				E/S 4.12.9 Construct, justify and defend mathematical conclusions using logical, sequential, **deductive reasoning** supported by established mathematical principles. E 10.12.4	Logic and Deductive Reasoning

Deductive Reasoning – The process of reasoning that starts from statements accepted as true and applied to a new situation to reach a conclusion (i.e., if a+ b = b+ a, 4+5 = 5+4).

Data Analysis

Content Standard 5.0: *To solve problems, communicate, reason, and make connections within and beyond the field of mathematics, students will collect, organize, display, interpret, and analyze data to determine statistical relationships and probability projections.*

By the end of **Grade 5**, students know and are able to do everything required in previous grades and:	By the end of **Grade 6**, students know and are able to do everything required in the previous grades and:	By the end of **Grade 7**, students know and are able to do everything required in the previous grades and:	By the end of **Grade 8**, students know and are able to do everything required in the previous grades and:	By the end of **Grade 12**, students know and are able to do everything required in the previous grades and:	
W/S 5.5.1 Collect, organize, read, and interpret data using a variety of graphic representations including tables, line plots, **stem and leaf plots**, scatter plots, **histograms**; use data to draw and explain conclusions and predictions. G 1.5.3; G 1.5.4; G 7.5.3; G 7.5.5; H 2.5.2; S 21.5.1; S 21.5.2; S 21.5.3; SS 22.5.2	5.6.1 Interpret data using various formats including circle graphs.	5.7.1 Organize, display, read, and analyze data, with and without technology, using a variety of displays including frequency **distributions** and circle graphs.	E/S 5.8.1 Organize, display, read, and analyze data, with and without technology, using a variety of displays including box and whisker plots. G 1.8.4; G 7.8.3; G 7.8.4; H 2.8.3; S 22.5.2	I/L 5.12.1 Use calculators and computers to create and manipulate tables, graphs, and matrices to communicate statistical information; use the shape of graphs of normal distributions to compare and analyze information. G 3.12.4; G 4.12.1; G 7.12.3; H 2.12.2; H 2.12.3; S 22.12.2	Data Collection and Organization

Distribution, Normal – A special type of smooth, symmetrical, bell-shaped distribution of data.
Histogram - Data grouped in intervals with the frequency of occurrence within each interval displayed.
Stem and Leaf Plot - A method of organizing data for the purpose of comparison where the "leaf" is the number in the smallest place value and the "stem" includes the numbers in the larger place values.

Content Standard 5.0: Data Analysis

By the end of **Grade 5**, students know and are able to do everything required in previous grades and:	By the end of **Grade 6**, students know and are able to do everything required in the previous grades and:	By the end of **Grade 7**, students know and are able to do everything required in the previous grades and:	By the end of **Grade 8**, students know and are able to do everything required in the previous grades and:	By the end of **Grade 12**, students know and are able to do everything required in the previous grades and:	
	5.6.2 Conduct simple probability experiments using concrete materials and represent the results using decimals, percents, and ratios.		I/S 5.8.2 Find the **theoretical probability** of an event using different counting methods (e.g., **tree diagrams**, **sample spaces**, and organized lists) and compare those results with actual (**experimental**) results, differentiating between the probability of an event and the **odds** of an event. S 22.8.3	I/L 5.12.2 Design, conduct, analyze, and communicate the results of multi-stage probability experiments. H 5.12.1	Probability
	5.6.3 Solve probability problems using a variety of methods including constructing sample spaces and tree diagrams.		I/S 5.8.3 Find the number of combinations possible in given situations using a variety of counting methods.	W/L 5.12.3 Distinguish between and apply **permutations** and combinations using a variety of methods, including The Fundamental Counting Principle. H 5.12.1	Probability Analysis

Experimental Probability – The frequency that a particular event occurs when compared to the total number of trials during an experiment.
Odds – Comparison of the number of "favorable outcomes" to the number of "unfavorable outcomes" in a probability experiment.
Permutation – An arrangement of items in which order is important (a list of the possible 1st, 2nd, and 3rd place winners).
Sample Space – A way to list all the possible results, or outcomes, for a probability experiment.
Theoretical Probability – Identifying, using mathematical expectations, the number of possible ways an event can happen compared to all of the possible events.
Tree Diagram – A method of finding all of the possible outcomes of an experiment by systematically listing the possibilities.

Content Standard 5.0: Data Analysis

By the end of **Grade 5**, students know and are able to do everything required in previous grades and:	By the end of **Grade 6**, students know and are able to do everything required in the previous grades and:	By the end of **Grade 7**, students know and are able to do everything required in the previous grades and:	By the end of **Grade 8**, students know and are able to do everything required in the previous grades and:	By the end of **Grade 12**, students know and are able to do everything required in the previous grades and:	
I/S 5.5.4 Model and then compute **measures of central tendency** including **mean**, **median**, and **mode**.		5.7.4 Select, use, and graph (when possible) measures of variability including range, distribution and possible outliers.		E/S 5.12.4 Select and use the measures of central tendency such as mean, median, mode and variability including range, distribution and possible outliers that are appropriate for given situations. G 7.12.4; S 20.12.4	Central Tendency
	5.6.5 Analyze the effect a change of format will have on interpretation of statistical charts and graphs.		E/L 5.8.5 Evaluate arguments that are based on data analysis for accuracy and validity; analyze the effect a change of scale or a change of format will have on statistical charts and graphs. S 19.8.1	E/S 5.12.5 Analyze the validity of statistical conclusions noting various sources of bias, misuse, and abuse of data caused by a wide variety of factors including choices of scale, probability versus odds, inappropriate uses of measures of central tendency, inaccurate curve fitting and inappropriate uses of controls or sample groups. S 19.12.1; S 21.12.2; S 21.12.3; S 23.12.6	Data Analysis

Mean – In a collection of data, the sum of all the data divided by the number of data.
Measures of Central Tendency – Numbers that represent information about cluster and "average" of a collection of data such as mean, median, mode, and geometric mean.
Median - The middle number (or average of the two middle numbers where necessary) in a collection of numbers that are arranged in order from least to greatest.
Mode – The number that occurs most often in a collection of data.

Content Standard 5.0: Data Analysis

By the end of **Grade 5**, students know and are able to do everything required in previous grades and:	By the end of **Grade 6**, students know and are able to do everything required in the previous grades and:	By the end of **Grade 7**, students know and are able to do everything required in the previous grades and:	By the end of **Grade 8**, students know and are able to do everything required in the previous grades and:	By the end of **Grade 12**, students know and are able to do everything required in the previous grades and:	
I/L 5.5.6 Describe the limitations of various graph formats; select an appropriate type of graph to **accurately** represent the data and justify the selection. G 5.5.6; G 5.5.7; G 7.5.3; G 7.5.5	5.6.6 Analyze data in a variety of formats to draw conclusions and make predictions	5.7.6 Given a set of data, interpolate and extrapolate to make and explain predictions.	I/S 5.8.6 Formulate reasonable inferences and projections based on **interpolations** and **extrapolations** of data to solve problems. S 20.8.2; S 23.8.6	I/L 5.12.6 Design, construct, analyze, and select an appropriate type of graph to represent data to communicate the results of statistical experiments (e.g., write a survey question and analyze and communicate the findings). S 22.12.2	Design

Accurate – "Accurate to a certain decimal place" means that all digits preceding and including the given place are correct using a prescribed rounding method. E.g., 1.26 is accurate to two places if obtained from 1.264, or 1.256, or 1.255, using the "round up if 5 or more" rule.
Extrapolation – Estimating the value of a number using the value of known numbers that precede it.
Interpolation – Estimating the value of a number using the value of known numbers on either side of the missing number.

Problem Solving

Process Standard 6.0: *Students will develop their ability to solve problems by engaging in developmentally appropriate problem solving opportunities in which there is a need to use various approaches to investigate and understand mathematical concepts in order to: formulate their own problems; find solutions to problems from everyday situations; develop and apply strategies to solve a wide variety of problems; and integrate mathematical reasoning, communication and connections.*

<table>
<tr><th>Kindergarten</th><th>Grade 1</th><th>Grade 2</th><th>Grade 3</th><th>Grade 4</th><th>Grade 5</th><th>Grade 6</th><th>Grade 7</th><th>Grade 8</th><th>Grade 12</th></tr>
<tr><td colspan="10">E/S
6.1
Select, modify, develop, and apply strategies to solve a variety of mathematical and practical problems and to investigate and understand mathematical concepts.
S 1.2.3; S 1.5.1; S 1.8.1; S 1.8.4; S 1.12.2; S 1.12.4; S 2.12.1; S 3.2.3; S 10.5.2; S 14.8.6; S 19.12.2; S 21.3.1</td></tr>
<tr><td colspan="10">E/S
6.2
Apply previous experience and knowledge to new problem-solving situations.</td></tr>
<tr><td colspan="3">E
6.3
Formulate problems; use various approaches to investigate and solve problems.</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="4">E/L
6.4
Explain and verify results with respect to the original problem.
S 23.2.5; S 23.3.5</td><td colspan="6">E/S
6.5
Verify, interpret, and evaluate results with respect to the original problem situation, determining an efficient strategy for the given situation.
S 21.5.3; S 21.12.3</td></tr>
<tr><td colspan="10">E/L
6.6
Try more than one strategy when the first strategy proves to be unproductive.</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td colspan="5">E/S
6.7
Apply multi-step, integrated, mathematical problem-solving strategies, persisting until a solution is found or until it is clear that no solution exists.
S 19.12.2</td></tr>
<tr><td colspan="4">E/L
6.8
Apply solutions and strategies from earlier problems to new problem situations.</td><td colspan="6">E/L
6.9
Generalize solutions and strategies from earlier problems to new problem situations.</td></tr>
<tr><td></td><td></td><td></td><td></td><td colspan="6">E/S
6.10
Interpret and solve a variety of mathematical problems by paraphrasing, identifying necessary and extraneous information, selecting and justifying efficient methods and/or strategies, and ensuring the answer is reasonable.</td></tr>
</table>

Strategy – A method or way of solving a problem.

Process Standard 6.0: Problem Solving

Kindergarten	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8	Grade 12
								E/L 6.11 Apply combinations of proven strategies and previous knowledge to solve non-routine problems.	
I/L 6.12 Use technology, including calculators, to understand quantitative relationships, e.g., for skip counting and pattern exploration.									
					E/L 6.13 Use technology, including calculators, to solve problems and verify solutions. S 24.5.5; S 24.8.5				
					E/L 6.14 Use technology, including calculators, to investigate, define, and describe quantitative relationships such as patterns and functions. G 7.12.3; S 1.5.1; S 1.12.2; S 1.12.4; S 14.8.6; S 24.5.5; S 24.8.5				

Mathematical Communication

Process Standard 7.0: *Students will develop their ability to communicate mathematically by solving problems in which there is a need to obtain information from the real world through reading, listening, and observing in order to: translate this information into a mathematical language and symbols; process this information mathematically; and present results in written, oral and visual formats.*

<table>
<tr><th>Kindergarten</th><th>Grade 1</th><th>Grade 2</th><th>Grade 3</th><th>Grade 4</th><th>Grade 5</th><th>Grade 6</th><th>Grade 7</th><th>Grade 8</th><th>Grade 12</th></tr>
<tr><td colspan="10">E/L
7.1
Discuss and exchange ideas about mathematics as a part of learning.
E 10.2.3; E 10.3.3; E 10.5.3; E 10.3.1; E 10.5.1; E 10.12.1; S 23.5.2</td></tr>
<tr><td colspan="10">E/L
7.2
Use inquiry techniques (e.g. discussion, questioning, research, data gathering) to solve mathematical problems.
E 4.2.3; E 10.2.2; E 10.3.2; E 10.5.2; E 10.8.2; E 11.2.1; E 11.3.1; E 11.5.1; E 11.8.1; E 11.12.1; E 11.2.2; S 1.5.1; S 1.8.1; S 1.8.4; S 1.12.4; S 10.5.2; S 14.8.6; S 21.3.1</td></tr>
<tr><td colspan="6"></td><td colspan="4">I/L
7.3
Read expository text to learn about mathematics.
E 1.8.3; E 1.12.3; E 2.12.3; E 4.8.1; E 4.8.2; E 4.8.3</td></tr>
<tr><td colspan="3">E
7.4
Use pictorial representations to identify mathematical operations and concepts.
S 22.2.2</td><td colspan="3">I/S
7.5
Identify and translate key words and phrases that imply mathematical operations.</td><td colspan="4">E/S
7.6
Interpret and solve word problems without the necessity of key words or phrases.</td></tr>
<tr><td colspan="4">E/S
7.7
Use physical materials, models, pictures, or writing to represent and communicate mathematical ideas.
E 6.3.3; G 1.3.3; G 4.2.1; G 4.2.6; G 4.3.1; G 7.2.5; G 7.3.3; G 7.3.5; G 7.2.3; H 1.3.1; H 1.3.2; S 13.3.2; S 20.3.1; S 21.2.1; S 21.2.2; S 21.3.2; S 22.2.2; S 24.2.4; S 24.3.4</td><td colspan="3">E/S
7.8
Use physical material, diagrams, and tables to represent and then communicate mathematical ideas through oral, verbal, and written formats.
E 11.5.5; G 1.5.4; G 7.5.3; G 7.5.5; H 1.5.1; S 1.5.1; S 20.5.1; S 22.5.2; S 23.5.2</td><td colspan="3">E/S
7.9
Model and explain mathematical relationships using oral, written, graphical, and algebraic methods.
E 5.8.1; E 5.8.2; E 6.8.2; E 11.8.5; E 11.12.5; S 1.12.2; S 1.12.4; S 14.8.6; S 20.12.1; S 22.8.2; S 22.12.2</td></tr>
<tr><td colspan="5"></td><td colspan="5">I/L
7.10
Evaluate the effectiveness of written and oral presentations of mathematics.
S 21.5.3; S 23.5.2</td></tr>
<tr><td colspan="5"></td><td colspan="5">E/L
7.11
Make conjectures and present arguments in discussions of mathematical ideas.
S 21.5.3; S 23.5.3</td></tr>
<tr><td colspan="6">W/L
7.12
Explain and justify thinking about mathematical ideas and solutions.
E 8.8.2; E 8.12.2; S 19.8.1</td><td colspan="4"></td></tr>
</table>

Process Standard 7.0: Mathematical Communication

Kindergarten	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8	Grade 12
						I/L 7.13 Explain and evaluate thinking about mathematical ideas and solutions. E 10.8.2; E 10.12.4; S 21.5.3		I 7.14 Explain and evaluate thinking about mathematical ideas and solutions based on the role of definitions, properties, common rules, and symbols in solving problems.	
E/L 7.15 Use everyday language to explain thinking about strategies and solutions to mathematical problems. S 21.5.3; S 23.5.3									
E/S 7.16 Express mathematical ideas and use them to define, compare, and solve problems orally and in writing.									
E/L 7.17 Use mathematical notation to communicate and explain mathematical situations. S 21.2.1									

Mathematical Reasoning

Process Standard 8.0: *Student will develop their ability to reason mathematically by solving problems in which there is a need to investigate significant mathematical ideas and* ***construct*** *their own learning in all content areas in order to justify their thinking; reinforce and extend their logical reasoning abilities; reflect on and clarify their own thinking; and ask questions to extend their thinking.*

<table>
<tr><th>Kindergarten</th><th>Grade 1</th><th>Grade 2</th><th>Grade 3</th><th>Grade 4</th><th>Grade 5</th><th>Grade 6</th><th>Grade 7</th><th>Grade 8</th><th>Grade 12</th></tr>
<tr><td colspan="5">I/L
8.1
Justify and explain the solutions to problems using manipulative and physical models.
3.2.3; S 20.3.3</td><td colspan="3">E/S
8.2
Justify answers and the steps taken to solve problems, with and without manipulatives and physical models.
S 1.5.1; S 10.5.2; S 20.5.1</td><td colspan="2">I/L
8.3
Construct, justify, and defend mathematical conclusions using logical arguments, in situations related to mathematics, science, and technology.
E 10.12.4; G 7.12.4; S 1.8.1; S 1.8.4; S 1.12.4; S 14.8.6</td></tr>
<tr><td colspan="10">E/S
8.4
Use patterns and relationships to analyze mathematical situations; draw logical conclusions about mathematical problems.
Ec 3.8.2; Ec 3.8.3; Ec 9.8.4; Ec 3.12.1; Ec 3.12.2; Ec 3.12.3; Ec 3.12.4; Ec 6.12.6; G 7.12.4; S 17.3.2</td></tr>
<tr><td colspan="4"></td><td colspan="6">E/L
8.5
Follow a logical argument and judge its validity.
E 4.8.4; E 4.12.4</td></tr>
<tr><td colspan="4"></td><td colspan="3">E/S
8.6
Apply deductive and inductive reasoning in mathematical situations to extend logical reasoning.
Ec 3.12.3</td><td colspan="3">E/S
8.7
Recognize and apply deductive and inductive reasoning in both concrete and abstract contexts.</td></tr>
<tr><td colspan="10">E/L
8.8
Ask questions to reflect on, clarify, and extend thinking.</td></tr>
<tr><td colspan="10">I/L
8.9
Review and refine the assumptions and steps used to derive conclusions in mathematical arguments.</td></tr>
</table>

Process Standard 8.0: Mathematical Reasoning

Kindergarten	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8	Grade 12
								I/L 8.10 Construct valid arguments; make and test conjectures about algebraic and geometric properties based on mathematical principles. E 10.12.4	
E/S 8.11 Determine relevant, irrelevant, and/or sufficient information to solve mathematical problems.									

Mathematical Connections

Process Standard 9.0: *Students will develop the ability to make mathematical connections by solving problems in which there is a need to view mathematics as an integrated whole, identifying relationships between context strands, and integrating mathematics with other disciplines, allowing the flexibility to approach problems in a variety of ways within and beyond the field of mathematics.*

<table>
<tr><td>Kindergarten</td><td>Grade 1</td><td>Grade 2</td><td>Grade 3</td><td>Grade 4</td><td>Grade 5</td><td>Grade 6</td><td>Grade 7</td><td>Grade 8</td><td>Grade 12</td></tr>
<tr><td colspan="10">E/L
9.1
Link new concepts to prior knowledge.</td></tr>
<tr><td></td><td colspan="9">E/S
9.2
Use mathematical ideas from one area of mathematics to explain an idea from another area of mathematics.</td></tr>
<tr><td></td><td></td><td></td><td></td><td colspan="6">E/S
9.3
Use models to explain the relationship of concepts to procedures.
S 1.5.1; S 1.8.1; S 1.12.2; S 1.8.4; S 1.12.4; S 10.5.2; S 14.8.6; S 20.5.1</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td><td colspan="4">I/L
9.4
Use the connections among mathematical topics to develop multiple approaches to problems.
S 20.8.1</td></tr>
<tr><td colspan="6">I/L
9.5
Identify practical applications of mathematical principles that can be applied to other disciplines.

S 14.12.5</td><td colspan="4">I/L
9.6
Use and analyze the connections between Mathematics and other disciplines.
Ec 2.8.2; Ec 2.12.4; Ec 2.12.8; H 2.8.3; H 2.12.3; S 2.12.1; S 14.12.5</td></tr>
<tr><td colspan="10">E/L
9.7
Apply mathematical thinking and modeling to solve problems that arise in other disciplines (e.g. rhythm in music and motion in science).
S 1.5.1; S 1.8.1; S 1.12.2; S 1.8.4; S 1.12.4; S 10.5.2; S 14.8.6; S 19.12.2</td></tr>
<tr><td colspan="10">I/S
9.8
Identify, explain, and use mathematics in everyday life.
Ec 2.3.2; Ec 2.12.12; Ec 5.2.1; Ec 5.3.1; S 24.12.2</td></tr>
</table>

Glossary for Mathematics

Absolute Value	A number's distance from zero on a number line. The absolute value of 2 is equal to the absolute value of –2.
Acute Angle	An angle that measures less than 90 degrees.
Accuracy	Correctness, usually referring to numerical computations. The accuracy of a table may mean either (1) the number of significant digits appearing in the table; (2) the number of correct places in computations made with the table.
Accurate	"Accurate to a certain decimal place" means that all digits preceding and including the given place are correct using a prescribed rounding method. E.g., 1.26 is accurate to two places if obtained from 1.264, or 1.256 or 1.255, using the "round up if 5 or more" rule.
Algorithm	A rule or procedure used to complete an exercise or solve a problem.
Amortization Table	A table used to display monthly payment costs (principal + interest) based on loan interest rate and the amount of time that will be used to repay the loan.
Angle of Inclination	The positive angle, less than 180 degrees, that measures the steepness of the slope.
Arc	A connected portion of a circle.
Area	The size of a two-dimensional region typically measured in square units.
Associative	The property which states that the manner of grouping three or more numbers when added or multiplied does not change the answer (e.g., 2+(3+5) = (2+3)+5).
Attribute	A characteristic of an object, such as color, shape, size, etc.
Bar Graph	A graph that uses horizontal or vertical bars to represent data.
Binomials	Algebraic expressions that can be represented by exactly two unlike terms when simplified, i.e., (2x + 3y).
Box and Whisper Plot	A graphic method used to display the middle (median) of a set of data, the middle of each half of that data, and the extremes of the data.
Calculate	(Compute) The process of adding, subtracting, multiplying, dividing or finding the square root of an equation/problem.
Capacity	The maximum amount of liquid a container can hold.
Chord	A straight line segment that connects two sides of a circle, but does not go through the exact center.
Commutative	The order in which two numbers are added or multiplied does not change the sum.
Complementary	Two angles whose measures sum exactly 90 degrees.

Composite Number	A whole number that is the result of at least two numbers (with "1" not one of the numbers) being multiplied together and that can be broken down into factors (i.e., 20 = 2 * 10).
Congruent	Figures that have the same size and shape.
Conjecture	An idea or theory that has not been proved.
Construction	The process of creating a figure or diagram, usually with a compass and straightedge, which will satisfy given conditions which describe it. Two axioms are necessary for all constructions (1) one and only one straight line may be drawn between two points and (2) with any given point as the center and any given distance as the radius, a circle may be drawn.
Converse of the Pythagorean Theorem	If the square of one of the sides of a triangle is equal to the sum of the squares of the other two sides of a triangle, then the triangle is a right triangle.
Convert	(Within a measurement system.) To change from one unit of measure to another. For example, 1 yard equals 36 inches.
Coordinate Grid	A (two-dimensional) flat surface formed by two intersecting number lines, one horizontal and one vertical, which can be used to name any point on the surface by an ordered pair of numbers.
Cylinder	A three-dimensional figure shaped like a soup can.
Deductive Reasoning	The process of reasoning that starts from statements accepted as true and applied to a new situation to reach a conclusion (i.e., if a+b = b+a, 4+5 = 5+4).
Denominator	The part of a fraction that defines the number of parts into which the whole number is divided.
Discrete Graph	A graph that has discontinuous information that results in breaks in the display (the graph shows the temperatures only for weekdays and not for weekends).
Diagram	A drawing or graphical representation used to illustrate mathematical relationships.
Digit	A digit is any one of the basic symbols used to write a numeral. For example, the numeral 23 is made up of the digits 2 and 3.
Distribution, Normal	A special type of smooth, symmetrical, bell-shaped distribution of data.
Domain	A collection of potential values to be used in place of the variable in a mathematical sentence describing a relationship.
Edge	The line formed when two faces of a three-dimensional figure intersect.
Empirical Statement	A statement that is based upon observation and experimental evidence.
Estimate	To give an approximate and reasonable answer for an arithmetical exercise without the need of calculating the exact answer.
Experimental Probability	The frequency that a particular event occurs when compared to the total number of trials during an experiment.

Exponent	A term that is used to describe the power to which a number or variable is raised. For example, in the expression 3^4, the 4 is referred to as the exponent.
Extend (pattern)	To continue a pattern or sequence with the same rules.
Extrapolation	Estimating the value of a number using the value of known numbers that precede it.
Face	The shape formed by one of the sides of a three-dimensional figure.
Face Value	The value assigned to each digit (0,1,2,3,4,etc.) used in our number system.
Formula	An equation that states a fact or rule (lw = A).
Frequency Table	A listing of data that includes the number of times an item occurs.
Function	An association of one object (or number) from one group or collection with one and only one object of another group or collection. This association is often represented in words, graphically, or algebraically.
Geometric Sequence	A sequence of numbers in which the next term can by found by multiplying the current term by some number (given the initial term 3 and a multiplier of 2 yields the geometric sequence of 3, 6, 12, 24…).
Greatest Possible Error	The measurement error which results from rounding or estimating a measurement to the nearest specified unit of measure.
Histogram	Data grouped in intervals with the frequency of occurrence within each interval displayed.
Hypotenuse	The side of a right (90 degree) triangle that is across from the right angle.
Indirect Measure	A measure found by using a formula or other strategy and not actually measuring something (i.e., finding the height of a tree without actually holding a ruler next to it).
Inductive Reasoning	A particular type of logic which involves drawing conclusions from several specific, known facts and using them to make generalizations about other, similar situations.
Integers	Positive and negative whole numbers.
Integral Exponent	An exponent that is a whole number or its opposite. For example, x^4 or y^{-4} have integral exponents, respectively of 4 and –4.
Interpolation	Estimating the value of a number using the value of known numbers on either side of the missing number.
Intersecting Lines	Lines that cross and have exactly one point in common.
Inverse Operations	Two operations that undo each other (i.e., addition and subtraction).
Irrational Numbers	Numbers which have infinite, but non-repeating, decimal representations.

Line of Symmetry	When an object can be folded in half to form two mirror objects.
Line Segments	Part of a line defined by two endpoints.
Linear Equation	An algebraic equation that describes a straight line.
Manipulatives	Tools, models, blocks, tiles, and other objects which are used to explore, represent and extend mathematical ideas and to solve mathematical problems.
Mass	The measure of the amount of matter of an object in the object's mass while an object's weight is a measure of the force with which gravity attracts the object. Although you mass is the same on Earth as it is on the Moon, you weigh more on Earth because the attraction of gravity is greater on Earth.
Mathematical Modeling	Representing or showing mathematical ideas and relationships using objects, pictures, graphs, equations and other methods.
Matrices	Plural of matrix. A way of displaying information in an array. For example, the expression $3x^2 + 4x + 2$ can be displayed in a matrix form as [3 4 2].
Mean	In a collection of data, the sum of all the data divided by the number of data.
Measures of Central Tendency	Numbers that represent information about cluster and "average" of a collection of data such as mean, median, mode, and geometric mean.
Median	The middle number (or the average of the two middle numbers when necessary) in a collection of numbers that are arranged in order from least to greatest.
Mode	The number that occurs most often in a collection of data.
Multiple	A multiple of a number is the product of that number and any whole number. For example, 24 is a multiple of 6.
Multiplicative Inverses	Two numbers whose product is one ($7 * 1/7 = 1$).
Non-Standard Units	Informal units of measure such as hand-full, arm's length, and stride.
Number Theory	The exploration of properties and characteristics of numbers.
Obtuse Angle	An angle with a measure that is greater than 90 degrees and less than 180 degrees.
Odds	Comparison of the number of "favorable outcomes" to the number of "unfavorable outcomes" in a probability experiment.
Odd Number	A whole number that has 1,3,5,7, or 9 in the ones place.
Operation	A term most commonly used to refer to addition, subtraction, multiplication, and division but may also refer to, for example, taking a square root, cubing a number, and intersecting sets.

Order of Operation	A rule used to provide conformity in the results of a string of operations. For example, 3+5x4-2 should be interpreted as equal to 21 because the order of operations requires that we multiply and divide before we add and subtract.
Ordered Pair	A pair of numbers that give the location of a point on a coordinate grid. The first number in the ordered pair describes the horizontal reference and the second describes the vertical.
Parallel Lines	Lines in the same plane that are always the same distance apart.
Perimeter	The sum of the lengths of the sides of a two-dimensional figure.
Permutation	An arrangement of items in which order is important (i.e., a list of the possible 1^{st}, 2^{nd}, and 3^{rd} place winners).
Perpendicular Lines	Two lines that intersect to form right angles.
Pictograph	A graph that shows numerical information by using picture symbols.
Place Value	The value of a digit as determined by multiplying its face value by its place value. For example, in the numeral 643, the 6 is in the "hundreds place" and represents a value of 600.
Plane Figure	A two-dimensional region.
Polygon	A simple, closed plane figure with sides consisting of line segments.
Polynomials	Algebraic expressions that can be represented by two or more unlike terms when simplified (i.e., $5x + 2y + 3z$).
Powers	A term that is used to describe an exponent. For example, the expression 3^4 can be read as 3 to the fourth power.
Powers of Ten	The expressions 10^0, 10^1, 10^2, 10^3, … are powers of ten and represent the numbers 1, 10, 100, 1000,…respectively.
Precision of Measurement	Precision of measurement tells how finely a measurement is made. The size of the units determines the precision. The smaller the unit, the more precise the measurement.
Prime Number	A whole number greater than 1 that has only 1 and itself as factors. For example, 13 is a prime number, 10 is not a prime number.
Prism	A three-dimensional figure with two opposite bases that are identical polygons and faces that are parallelograms.
Probability	The number of favorable outcomes compared to the number of possible outcomes of an experiment.
Proportions	An equation that represents the equality of two ratios.
Pyramid	A three dimensional figure with a flat base and triangular sides that meet in a point.
Pythagorean Theorem	If a triangle is a right triangle, then the square of the length of one leg added to the square of the length of the other leg is equal to the square of the hypotenuse.

Quadrant	Labels for the four regions formed by the axes of a coordinate grid. The first quadrant is the region which includes only positive ordered pairs.
Radicals	A term used to refer to roots of numbers such as the cube root of 5.
Range	The solutions determined by evaluating a mathematical sentence using its domain.
Ratio	A comparison of two quantities or a rate of change.
Rational Number	A number that can be written in the form of a fraction.
Ray	A part of a line that has one endpoint and extends endlessly in one direction.
Real Numbers	The rational numbers and the irrational numbers.
Reflection	The mirror image of a figure often referred to as a flip.
Regrouping	Regrouping occurs in a mathematical operation when numbers are renamed such as 2 tens and 14 ones is renamed as 34 or vice-versa, e.g., "carrying" and "borrowing".
Replacement Set	A collection of potential values to be used in place of the variable in an open mathematical sentence.
Right Angle	An angle that measures exactly 90 degrees.
Right Triangle	A triangle in which one angle is a right angle (equal to 90 degrees).
Root	A number that can be used as a factor a given number of times to produce the original number (i.e., the fifth root of 32 is 2 because 2 x 2 x 2 x 2 x 2 = 32).
Rotation	A transformation obtained by rotating a figure around a given point often referred to as a turn.
Rounding Numbers	Expressing a number to the nearest one, nearest ten, nearest hundred and so on.
Sample Space	A way to list all the possible results or outcomes for a probability experiment.
Scientific Notation	A method of representing a number as a product of a number between 0 and 10 and a power of ten. For example, 3456 can be written as 3.456×10^3.
Secant	A straight line intersecting the circle at two points.
Sequence	A series of numbers that are predictable and can be extended using simple addition or subtraction (4, 7, 10, 13…).
Skip Count	To count by multiples of a number (count by two, five, tens, etc.)

Slope	The degree of steepness of a line (or curve) as measured by pitch or rise over run.
Solve	To find all the solutions of an equation or other mathematical problem.
Standard Units	Units of measure that have an accepted value like inch, cup, meter, and pound.
Stem and Leaf Plot	A method of organizing data for the purpose of comparison where the "leaf" is the number in the smallest place value and the "stem" includes the numbers in the larger place values.
Strategy	A method or way of solving a problem.
Substitution Algebra	Substituting or replacing something, a variable or an expression, in one equation with an equivalent expression from the other equation.
Supplementary Angles	Two angles whose measures total exactly 180 degrees.
Symbolic Language	Mathematical ideas expressed in a symbol or group of symbols.
Symmetry	When an object can be folded in half to form two mirror objects (line symmetry) or when an object can be rotated less than 360 degrees about a point to coincide with an image of the object (rotational symmetry).
Tangent	A straight line intersecting the circle at exactly one point.
Tessellation	A covering of a plane with congruent shapes that exactly cover the area (tiling).
Theoretical Probability	Identifying, using mathematical expectations, the number of possible ways an event can happen compared to all of the possible events.
Three-Dimensional	A figure that is three-dimensional is one which has length, height, and breadth.
Tolerance	The allowable error in a given measurement. If a part has a given measure of 5.125" – the error allowable when making the pat may be 0.005" more or less than the actual measure of 5.125". The standard way of writing the tolerance allowed is 5.125 +/- 0.005:, which means that any measure between 5.120" and 5.130" would be acceptable.
Translation	Changing the position of an object by sliding it in any direction without rotation or reflection. Translations are often referred to as slides.
Transversal	The name given to a line that intersects two or more other lines in a given plane.
Tree Diagram	A method of finding all of the possible outcomes of an experiment by systematically listing the possibilities.
Triangular Numbers	The numbers 1, 3, 6, 10... are triangular because they can be expressed by employing the number of dots in successive triangular arrays of dots (this can be thought of as 1, 1+2, 1+2+3, 1+2+3+4, ...).
Triangle Sum Theorem	The sum of the interior angles of any triangle is equal to 180 degrees.
Two-Dimensional	A figure that is two-dimensional is one which can be represented on a coordinate grid.

Validate	To give evidence that a solution or process is correct.
Variable	A variable is a symbol, such as a letter, box, star, etc., used to represent an unknown or undetermined value in an expression or number sentence.
Verify	The process of demonstrating or proving that a response is correct.
Vertex	(Plural is vertices.) The point where two sides of a two-dimensional figure meet or the point where two or more edges of a three-dimensional figure meet.
Volume	The size of a three-dimensional shape typically measured in cubic units.
Whole Numbers	The set of natural numbers plus the number zero, i.e., (0, 1, 2, 3, 4...).

SE

Performance Level Descriptors
Mathematics

Grade 2

Content Standard 1.0	**Numbers, Number Sense, and Computation:** To solve problems, communicate, reason, and make connections within and beyond the field of mathematics, students will accurately calculate and use estimation techniques, number relationships, operation rules, and algorithms; they will determine the reasonableness of answers and the accuracy of solutions.
EXCEEDS STANDARD	• Immediately recall and use basic addition facts (sums through 18) and the corresponding subtraction facts. • Add and subtract multi-place numbers with and without regrouping. • Generate, write, and solve two-step addition and subtraction problems based on practical situations. • Add and subtract money amounts using decimals. • Use the patterns in numbers to skip count by 2s through 10s to 100 and beyond. • Read and write numerals and order and compare numbers from 0-999 and beyond. • Estimate, with reasonable results, the number of objects in a set of 20 or more. • Read and write number words to 20 and beyond and use the ordinal positions through the twentieth and beyond. • Use, model, and identify the place value positions of 1s, 10s, 100s, and 1,000s. • Identify, model, and label unit fractions as parts of a whole.
MEETS STANDARD	• Identify and model basic addition facts (sums to 18) and the corresponding subtraction facts and immediately recall the addition facts with sums through 10 and the corresponding subtraction facts. • Add and subtract multi-place numbers without regrouping. • Generate, write, and solve one step addition and subtraction problems based on practical situations. • Use decimals to show money amounts. • Use the patterns in numbers to skip count by 2s, 3s, 5s, and 10s to 100 and beyond. • Read and write numerals and order and compare numbers from 0-999. • Estimate, with reasonable results, the number of objects in a set to 20. • Read and write number words through 20 and use, model, and identify the ordinal positions first through the twentieth. • Use, model, and identify the place value positions of 1s, 10s, and 100s. • Identify, model, and label 1/2 and 1/4 as parts of a whole.
APPROACHES STANDARD	• Identify and model basic addition facts (sums through 18) and the corresponding subtraction facts and immediately recall the addition facts with sums through 10 and the corresponding subtraction facts, though not yet consistently. • Add and subtract multi-place numbers without regrouping, with inconsistent results. • Generate, write, and solve, with occasional errors, one step addition and subtraction problems, based on practical situations. • Use decimals, with some inconsistency, to show money amounts. • Use the patterns in numbers to skip count by 2s, 5s, and 10s to 100, missing an occasional number. • Read and write numerals and order and compare numbers from 0-999 with inconsistent results. • Estimate, with inconsistent results, the number of objects in a set to 20. • Read and write number words to 20 and use, model, and identify the ordinal positions first through the twentieth, though not yet consistently. • Use, model, and identify, with errors, the place value positions of 1s, 10s, and 100s. • Identify, model, and label 1/2 and 1/4 as parts of a whole, though not yet consistently.

Performance Level Descriptors
Mathematics

Grade 2 (Standard 1.0 continued)

BELOW STANDARD	• Identify and model the addition facts with sums through 10 and the corresponding subtraction facts, with assistance. • Add multi-place numbers without regrouping. • Model, write, and solve one-step addition problems based on practical situations. • Use decimals to show money amounts, with assistance. • Use the patterns in numbers to skip count by 2s, 5s, and 10s through 100, with assistance. • Read and write numerals and order and compare numbers from 0-99, with assistance. • Estimate the number of objects in a set to 10. • Read and write number words through 10 and use, model, and identify the ordinal positions first through the tenth, with errors. • Use, model, and identify the place value positions of 1s and 10s and 100s, with assistance. • Identify, model, and label 1/2 and 1/4, with assistance.

Performance Level Descriptors
Mathematics

Grade 2

Content Standard 2.0	**Patterns, Functions, and Algebra:** To solve problems, communicate, reason, and make connections within and beyond the field of mathematics, students will use various algebraic methods to analyze, illustrate, extend, and create numerous representations (words, numbers, tables, and graphs) of patterns, functions, and algebraic relations as modeled in practical situations.
EXCEEDS STANDARD	• Recognize, describe, extend, create, and use complex repeating and increasing patterns with symbols, objects, manipulatives, and numbers to solve problems, using calculators and computers when available. • Use variables and number relationships to identify missing terms in open sentences. • Create, model, explain, and solve addition and subtraction number sentences to describe situations involving equality and inequality.
MEETS STANDARD	• Recognize, describe, extend, create, and use repeating and increasing patterns using symbols, objects, and manipulatives to solve problems. • Use variables and open sentences to express relationships. • Create, model, explain, and solve problems using addition and subtraction.
APPROACHES STANDARD	• Recognize, describe, extend, create, and use simple repeating patterns, using symbols, objects, and manipulatives to solve problems, with inconsistent results. • Use variables and open sentences to express simple relationships. • Model, explain, and solve problems based on numerical sentences with inconsistent results,.
BELOW STANDARD	• Recognize, describe, extend, create, and use simple repeating patterns using symbols, objects, and manipulatives to solve problems, with assistance. • Use variables in open addition sentences to express relationships, with assistance. • Model and solve problems using manipulatives based on simple numerical sentences, with assistance.

Performance Level Descriptors
Mathematics

Grade 2

Content Standard 3.0	**Measurement:** To solve problems, communicate, reason, and make connections within and beyond the field of mathematics, students will use appropriate tools and techniques of measurement to determine, estimate, record, and verify direct and indirect measurements.
EXCEEDS STANDARD	• Identify and use the correct unit of measure for time, temperature, length, weight, capacity, volume, and area and describe and define various attributes. • Identify and use the correct unit of measure to compare differences in objects that are greater than, less than, and /or equal to a given unit. • Create possible combinations of bills and coins to equal a given amount. • Use a calendar to identify days, weeks, months, year(s), and elapsed time to solve problems. • Read time to the nearest five minute interval.
MEETS STANDARD	• Compare and order objects by various measurable attributes, such as time, temperature, length, weight, capacity, volume, and area and describe and define these various attributes. • Compare objects that are greater than, less than, and /or equal to a given unit of measure such as inch, yard, centimeter, and meter. • Determine the value of any given set of coins and bills. • Recite and use the months of the year in order and use a calendar to identify days, weeks, months, and year. • Read time to the nearest quarter hour and distinguish between A.M. and P.M.
APPROACHES STANDARD	• Compare and order objects by various measurable attributes, such as time, temperature, length, weight, and area. • Compare objects that are greater than, less than, and /or equal to a given unit, with inconsistent results. • Determine the value of any given set of coins. • Recite the months of the year in order with a few errors, and use a calendar to identify days, weeks, months, and year, but not yet consistently. • Read time to the nearest half hour and distinguish between A.M. and P.M.
BELOW STANDARD	• Compare objects by simple measurable attributes, such as temperature, length, weight, and area, communicating their similarities and differences, with assistance. • Compare objects that are greater than, less than, and/or equal to a given unit, with assistance. • Determine the value of any given set of coins under one dollar. • Recite the months of the year in order, with assistance, and use a calendar to identify days, weeks and months, though not yet consistently. • Read time to the nearest half hour; distinguish between A.M. and P.M., with assistance.

Performance Level Descriptors
Mathematics

Grade 2

Content Standard 4.0	**Spatial Relationships and Geometry:** To solve problems, communicate, and make connections within and beyond the field of mathematics, students will identify, represent, verify, and apply spatial relationships and geometric properties.
EXCEEDS STANDARD	• Identify, sort, sketch, describe, compare, and contrast plane geometric figures regardless of position. • Describe the location of objects and, when given directions, place objects in position relative to each other. • Identify and describe similar and congruent two-dimensional figures regardless of how they are positioned relative to each other. • Identify symmetry in figures in the environment and create figures and designs that have more than one line of symmetry. • Describe, sketch, model, and build two- and three- dimensional figures.
MEETS STANDARD	• Identify, name, sort, sketch, describe, and compare circles, triangles, and rectangles including squares, regardless of position. • Describe the location of objects and place objects in position using vocabulary such as before, far, below, and left. • Compare the size of similar two-dimensional figures and identify shapes that are congruent. • Identify symmetry in figures in the environment and create figures and designs that have a line of symmetry. • Identify, name, sort, describe, compare, and contrast two- and three-dimensional figures.
APPROACHES STANDARD	• Identify, name, sort, sketch, describe, and compare circles, triangles, and rectangles including squares, with errors. • Place objects in given positions using vocabulary such as near, below, right, and over. • Compare the size of similar two-dimensional figures and identify shapes that are congruent, when they are positioned the same way relative to each other. • Identify symmetry in figures in the environment and inconsistently create figures and designs that have a line of symmetry. • Identify, name, sort, describe, compare, and contrast two- or three-dimensional figures, though not yet consistently.
BELOW STANDARD	• Identify, name, and sort circles, triangles, and rectangles including squares, with assistance. • Place objects in position using vocabulary such as near, below, right, with inconsistent results. • Identify figures in the environment that have a line of symmetry. • Describe similar or congruent two-dimensional figures when they are positioned in the same way, with assistance. • Compare, contrast, and match circles, triangles, and rectangles including squares to their corresponding three-dimensional figures, with assistance.

Performance Level Descriptors
Mathematics

Grade 2

Content Standard 5.0	**Data Analysis:** To solve problems, communicate, reason, and make connections within and beyond the field of mathematics, students will collect, organize, display, interpret, and analyze data to determine statistical relationships and probability projections.
EXCEEDS STANDARDS	• Collect, organize, record, explain, and analyze data using concrete materials and surveys.
MEETS STANDARD	• Collect, organize, record, and explain classification of data using concrete materials.
APPROACHES STANDARD	• Collect, organize, record, and explain classification of data using concrete materials, with occasional errors and/or weak explanations.
BELOW STANDARD	• Collect, organize, record, and explain classification of data using concrete materials, with assistance.

Performance Level Descriptors
Mathematics

Grade 3

Content Standard 1.0	**Numbers, Number Sense, and Computation:** To solve problems, communicate, reason, and make connections within and beyond the field of mathematics, students will accurately calculate and use estimation techniques, number relationships, operation rules, and algorithms; they will determine the reasonableness of answers and the accuracy of solutions.
EXCEEDS STANDARD	• Immediately recall and use addition and subtraction facts and multiplication facts with products greater than 81. • Add and subtract multi-place decimals with regrouping. • Use pencil and paper, mental computation, and estimation to generate and solve complex two-step addition and subtraction problems based on practical situations. • Generate and solve two-step multiplication problems based on practical situations, using paper and pencil, mental computation, and estimation. • Create problems that require the addition and subtraction of decimals that represent money amounts. • Explain multiplication using a variety of models. • Read and write numerals and compare and order numbers from 0-9,999 and beyond. • Determine the reasonableness of answers by rounding to the nearest ten, hundred, and beyond. • Use, model, and identify place value positions beyond 10,000. • Model, sketch, and label fractions with denominators to 10 and beyond. • Write fractions using both numerals and number words.
MEETS STANDARD	• Immediately recall and use addition and subtraction facts and multiplication facts with products through 81. • Add and subtract multi-place numbers with regrouping. • Use pencil and paper, mental computation, and estimation to generate and solve two-step addition and subtraction problems based on practical situations. • Generate and solve one-step multiplication problems based on practical situations using paper and pencil, mental computation, and estimation. • Add and subtract decimals that represent money amounts. • Use addition to model and explain multiplication. • Read and write numerals and compare and order numbers from 0-9,999. • Determine the reasonableness of answers by rounding to the nearest ten and hundred. • Use, model, and identify place value positions through 10,000. • Model, sketch, and label fractions with denominators to 10. • Write commonly used fractions using both numerals and number words.
APPROACHES STANDARD	• Immediately recall and use addition and subtraction facts and multiplication facts with products through 81, though not yet consistently. • Add and subtract multi-place numbers with regrouping with some errors. • Use pen and paper, mental computation, and estimation to generate and solve simple two-step addition and subtraction problems based on practical situations, though not yet consistently. • Generate and solve, with some degree of inconsistency, one-step multiplication problems based on practical situations using paper and pencil, mental computation, and estimation. • Add and subtract decimals that represent money amounts, with occasional errors. • Use addition to model multiplication. • Read and write numerals and compare and order numbers from 0-9,999, with inconsistent results. • Round to the nearest ten and hundred. • Use, model, and identify place value positions to 10,000 with some success. • Model, sketch, and label fractions with denominators to 10, though not yet consistently. • Write commonly used fractions using numerals.

Grade 3(Standard 1.0 continued)

BELOW STANDARD	• Recall and use addition and subtraction and multiplication facts with products through 81, with errors. • Add and subtract multi-place numbers without regrouping. • Use pencil and paper, mental computation, and estimation to generate and solve simple one-step addition and subtraction problems based on practical situations. • Solve one-step multiplication problems, with assistance, based on practical situations using paper and pencil, mental computation, and estimation. • Add decimals that represent money amounts. • Use addition to model and multiplication, with assistance. • Read and write numerals and compare and order numbers from 0-9,999 with assistance. • Round to the nearest ten. • Use, model and identify place value positions of 1s, 10s, and 100s. • Model, sketch, and label unit fractions with denominators to 10. • Write commonly used fractions using numerals, with inconsistent results.

Performance Level Descriptors
Mathematics

Grade 3

Content Standard 2.0	**Patterns, Functions, and Algebra:** To solve problems, communicate, reason, and make connections within and beyond the field of mathematics, students will use various algebraic methods to analyze, illustrate, extend, and create numerous representations (words, numbers, tables, and graphs) of patterns, functions, and algebraic relations as modeled in practical situations.
EXCEEDS STANDARD	• Recognize, describe, extend, and create repeating, increasing and decreasing patterns using numbers; use number patterns and their extensions to solve complex problems using complicated patterns. • Identify missing symbols (+, -, X, >, <, =) and missing numbers in open number sentences involving number facts in addition, subtraction, and multiplication.
MEETS STANDARD	• Recognize, describe, extend, and create repeating and increasing patterns using numbers; use number patterns and their extensions to solve problems. • Identify missing symbols (+, -, >, <, =) and missing numbers in open number sentences involving number facts in addition and subtraction.
APPROACHES STANDARD	• Recognize, describe, extend, and create repeating and increasing patterns using numbers; use number patterns and their extensions to solve simple problems, with assistance. • Identify missing symbols (+, -, >, <, =) and missing numbers in open number sentences involving number facts in addition and subtraction, with some errors.
BELOW STANDARD	• Recognize, describe, extend, and create repeating and increasing patterns using numbers. • Identify missing symbols (+, -, >, <, =) and missing numbers in open number sentences involving number facts in addition and subtraction, though not yet independently.

Performance Level Descriptors
Mathematics

Grade 3

Content Standard 3.0	**Measurement:** To solve problems, communicate, reason, and make connections within and beyond the field of mathematics, students will use appropriate tools and techniques of measurement to determine, estimate, record, and verify direct and indirect measurements.
EXCEEDS STANDARD	• Measure to a required degree of accuracy and record the measurements, evaluating for error and describing the appropriateness of self-selected units of measure. • Estimate measurements and select and use appropriate measuring devices with standard units to measure length, surface area, liquid volume, capacity, temperature, and weight. • Read, write, and use money notation and determine possible combinations of coins and bills to equal given amounts, and apply to practical situations. • Read time to the nearest minute using analog and digital clocks and determine elapsed time, applying it to practical situations.
MEETS STANDARD	• Measure to a required degree of accuracy, record the measurement, and evaluate it for error, describing the appropriateness of selected units of measure. • Estimate measurements and use measuring devices with standard and non-standard units to measure length, area of a region, liquid volume, capacity, temperature, and weight, communicating the concepts of more, less, and equivalent. • Read, write, and use money notation and determine possible combinations of coins and bills to equal given amounts. • Read time to the nearest minute using analog and digital clocks and determine elapsed time.
APPROACHES STANDARD	• Measure, with inconsistent accuracy, and record the measurement, identifying the appropriate unit of measure, though not always correctly. • Estimate measurements, with assistance, and use measuring devices with non-standard units to measure length, liquid volume, capacity, temperature, and weight, communicating the concepts of more, less, and equivalent. • Read, write, and use money notation, and determine a possible combination of coins and bills to equal given amounts, with inconsistent results. • Read time to the nearest minute, using analog and digital clocks, and determine elapsed time, though not yet consistently.
BELOW STANDARD	• Measure objects, with inconsistent accuracy, and record the measurements. • Use measuring devices with non-standard units to measure length, temperature, and weight, communicating the concepts of more, less, and equivalent. • Read, write, and use money notation and determine a possible combination of coins and bills to equal given amounts, with assistance. • Read time to the nearest minute using analog and digital clocks.

Performance Level Descriptors
Mathematics

Grade 3

Content Standard 4.0	**Spatial Relationships and Geometry:** To solve problems, communicate, and make connections within and beyond the field of mathematics, students will identify, represent, verify, and apply spatial relationships and geometric properties.
EXCEEDS STANDARD	• Describe, sketch, compare, and contrast plane geometric figures in great detail. • Demonstrate and describe a sequence of transformations (motions) of geometric figures as slides, rotations, and/or flips. • Describe, sketch, model, build, compare, and contrast two- and three-dimensional geometric figures, with great detail.
MEETS STANDARD	• Describe, sketch, compare, and contrast plane geometric figures. • Demonstrate and describe the transformation (motion) of a geometric figure as a slide, rotation, or a flip. • Describe, sketch, model, build, compare, and contrast two- and three-dimensional geometric figures.
APPROACHES STANDARD	• Describe, sketch, and compare plane geometric figures. • Demonstrate and describe with some errors, the motion (transformation) of a geometric figure as a slide, rotation, or a flip. • Describe, sketch, model, build, compare, and contrast two- and three-dimensional geometric figures, with assistance.
BELOW STANDARD	• Describe, draw, and compare plane geometric figures, with assistance. • Demonstrate sliding, rotating, and flipping a geometric figure. • Describe, draw, model, build, and compare two- and three-dimensional geometric figures, with assistance.

Performance Level Descriptors
Mathematics

Grade 3

Content Standard 5.0	**Data Analysis:** To solve problems, communicate, reason, and make connections within and beyond the field of mathematics, students will collect, organize, display, interpret, and analyze data to determine statistical relationships and probability projections.
EXCEEDS STANDARD	• Collect, organize, display, describe, and interpret simple data using number lines, pictographs, bar graphs, and frequency tables, by hand and with computers when they are available. • Use concepts of probability to make predictions about future events.
MEETS STANDARD	• Collect, organize, display, and describe simple data using number lines, pictographs, bar graphs, and frequency tables, by hand and with computers when they are available. • Use concepts of probability such as impossible, unlikely, likely, and certain to make predictions about future events.
APPROACHES STANDARD	• Collect, organize, display, and describe simple data, with inconsistent results, using number lines, pictographs, bar graphs, and frequency tables, by hand and with computers when they are available. • Use concepts of probability such as impossible, unlikely, likely, and certain to make predictions about familiar events.
BELOW STANDARD	• Collect, organize, display, and describe, simple data, with assistance, in one or more ways, by hand and with computers when they are available. • Use concepts of probability such as impossible, unlikely, likely and certain to make predictions about familiar events, with inconsistent results.

Performance Level Descriptors
Mathematics

Grade 5

Content Standard 1.0	**Numbers, Number Sense and Computation:** To solve problems, communicate, reason, and make connections within and beyond the field of mathematics, students will accurately calculate and use estimation techniques, number relationships, operation rules, and algorithms; they will determine the reasonableness of answers and the accuracy of solutions.
EXCEEDS STANDARD	• Immediately recall and use multiplication and corresponding division facts. • Multiply and divide multi-place numbers. • Generate and solve complex addition, subtraction, multiplication, division problems involving whole numbers and order of operations in practical situations. • Compare and order negative numbers within the context of practical situations and plot rational numbers on a number line. • Estimate, using a variety of methods, to determine and justify the reasonableness of an answer. • Model, draw, identify, compare, add, and subtract decimals and fractions with like and unlike denominators to solve problems.
MEETS STANDARD	• Immediately recall and use multiplication and corresponding division facts using factors of 0 through 12. • Multiply and divide multi-place numbers by two-digit numbers including multiples of 10. • Generate and solve addition, subtraction, multiplication, and division problems involving whole numbers and order of operations in practical situations. • Compare and order negative numbers within the context of practical situations and plot integer values on a number line. • Estimate to determine the reasonableness of answer by identifying and using the correct place value position. • Model, draw, identify, compare, add, and subtract decimals and fractions with like denominators to solve problems.
APPROACHES STANDARD	• Immediately recall and use multiplication and corresponding division facts using factors 0 through 12, with inconsistent results. • Multiply and divide multi-place numbers by two-digit numbers including multiples of 10, with inconsistent results. • Generate addition, subtraction, multiplication, and division problems involving whole numbers and order of operations to solve problems, with errors. • Compare and order negative numbers within the context of practical situations and plot integers on a number line, with inconsistent results. • Use a given place value in rounding and estimating to determine the reasonableness of an answer. • Use models and drawings to identify, compare, add, and subtract decimals and fractions with like denominators, using both to solve problems, with inconsistent results.
BELOW STANDARD	• Immediately recall and use multiplication and corresponding division facts using factors of 0 through 10, though not yet consistently. • Use multiplication and corresponding division facts to multiply and divide multi-place numbers by single-digit numbers, with inconsistent results. • Solve addition, subtraction, multiplication, and division problems, though not yet consistently. • Use negative numbers to describe temperatures and plot negative and positive numbers on a number line. • Use rounding and estimation in specified situations, with inconsistent accuracy. • Use models and drawings to identify, compare, add, and subtract decimals and fractions with like denominators to solve problems, with assistance.

Performance Level Descriptors
Mathematics

Grade 5

Content Standard 2.0	Patterns, Functions, and Algebra: **To solve problems, communicate, reason, and make connections within and beyond the field of mathematics, students will use various algebraic methods to analyze, illustrate, extend, and create numerous representations (words, numbers, tables, and graphs) of patterns, functions, and algebraic relations as modeled in practical situations.**
EXCEEDS STANDARD	• Create tables and charts to identify, describe, and extend number patterns and relationships. • Use variables in open sentences to describe a wide variety of functions and relationships. • Solve simple equations and inequalities using whole numbers, decimals, and common fractions. • Generate complex number sequences given the first term of the sequence and any computation rule.
MEETS STANDARD	• Identify, describe, and explain number patterns and relationships, including triangular numbers, perfect squares, arithmetic and geometric sequences, using concrete materials, paper and pencil, and calculators. • Use variables in open sentences to describe simple functions and relationships. • Solve simple whole numbers equations and inequalities using a variety of methods. • Generate number sequences given the first term of the sequence and any simple computation rule.
APPROACHES STANDARD	• Identify, describe, and explain simple number patterns and relationships, including arithmetic and geometric sequences, using concrete materials, paper and pencil, and calculators when available, though not yet consistently. • Use variables, though not yet consistently, in open sentences to describe simple functions and relationships. • Solve simple equations and inequalities, with inconsistent results, involving whole numbers using a variety of methods. • Generate simple number sequences given the first term of the sequence and any simple computation rule, with inconsistent results.
BELOW STANDARD	• Identify simple number patterns and relationships, including arithmetic and geometric sequences, using concrete materials, paper and pencil, and calculators when available, though not yet consistently. • Use open number sentences to represent simple functions and relationships, with assistance. • Solve simple whole number equations and some inequalities, though not yet consistently. • Generate simple number sequences given the first term of the sequence and any simple computation rule, with assistance.

Performance Level Descriptors
Mathematics

Grade 5

Content Standard 3.0	**Measurement:** To solve problems, communicate, reason, and make connections within and beyond the field of mathematics, students will use appropriate tools and techniques of measurement to determine, estimate, record, and verify direct and indirect measurements.
EXCEEDS STANDARD	• Measure and compare lengths, masses, and capacities and convert those measurements within the same measurement system. • Estimate measures of length, volume, capacity, quantity, and weight justifying the reasonableness of the estimates. • Select the method of measurement and justify the use of estimation or direct measurement. • Determine several different combinations of bills and coins that would provide correct change in practical situations. • Determine the perimeter and area of given polygons, and describe how changes in dimensions affect changes in area. • Convert units of time to equivalent units.
MEETS STANDARD	• Measure, compare, and convert units of length, within the same measurement system, to the nearest fractional/decimal part. • Estimate and directly measure length, volume, capacity, and quantity. • Select and justify the use of estimation or direct measurement and weight in a given situation. • Determine the total cost of purchases and the amount of change in practical situations. • Describe the difference between perimeter and area and determine the perimeter of any polygon and the area of right triangles and rectangles, including squares. • Identify equivalent periods of time using relationships between and among seconds, minutes, hours, days, months, and years.
APPROACHES STANDARD	• Measure and compare lengths within the same measurement system to the nearest fraction/decimal part. • Estimate measures of length, quantity, and weight. • Explain why estimation or direct measurements are preferred or required in specific situations. • Determine correct change when given total cost and amount tendered. • Determine the perimeter of any polygon and area of given right triangles and rectangles, including squares. • Identify equivalent periods of time using relationships between and among seconds, minutes, hours, days, months, and years.
BELOW STANDARD	• Measure and compare lengths. • Estimate and compare measures of length. • Explain why estimation or precise measurements are preferred or required in specific situations, with assistance. • Determine correct change given total cost of a purchase and amount tendered, with inconsistent results. • Determine the perimeter of any polygon and the area, with errors, of given right triangles and rectangles, including squares. • Identify some equivalent periods of time, using relationships between and among seconds, minutes, hours, days, months, and years, with assistance.

Performance Level Descriptors
Mathematics

Grade 5

Content Standard 4.0	**Spatial Relationships and Geometry:** To solve problems, communicate, and make connections within and beyond the field of mathematics, students will identify, represent, verify, and apply spatial relationships and geometric properties.
EXCEEDS STANDARD	• Draw and classify angles and triangles according to given measurements. • Identify, draw, and label circles and elements of circles, describing the relationships between the various elements. • Identify transformations as a translation, rotation, reflection, enlargement, or reduction using the formal vocabulary for shapes that have congruence, similarity, and symmetry. • Identify and draw shapes that have congruence, similarity, and symmetry using a wide variety of methods. • Graph ordered pairs and identify coordinates for a given point in any quadrant. • Draw and classify complex two- and three-dimensional figures by their properties including the number of vertices, and edges and the number and shape of the faces. • Identify, describe, classify, and construct one- and two dimensional geometric figures including intersecting, perpendicular and parallel lines, line segments, rays, and angles when given measurements and describe the relationships among various elements.
MEETS STANDARD	• Draw and classify angles and triangles as right, acute, or obtuse. • Identify and draw circles and elements of circles, describing the relationships between the various elements. • Identify a transformation as translation, rotation, reflection, enlargement, or reduction. • Identify shapes that have congruence, similarity, and/or symmetry using a variety of methods, including transformational motions and models, drawings, and measurement tools. • Graph ordered pairs and identify coordinates for a given point in the first quadrant. • Identify, describe, compare and classify two- and three-dimensional figures by their properties including the number of vertices, and edges and the number and shape of the faces. • Identify, describe, classify and draw one- and two-dimensional geometric figures including intersecting, perpendicular and parallel lines, line segments, rays, and angles with given measurements.
APPROACHES STANDARD	• Draw, with errors, and classify angles and triangles as right, acute, or obtuse. • Identify and draw circles and elements of circles, displaying some understanding of the relationships between the various elements. • Identify transformations as slides, turns, flips, larger, or smaller, with errors. • Identify shapes that have congruence, similarity, and/or symmetry using visual comparisons. • Graph ordered pairs and identify coordinates for a given point in the first quadrant, with inconsistent accuracy. • Identify, describe, compare and classify, with inconsistent results, common three-dimensional figures by their properties including the number of vertices, edges, and shape of their faces. • Identify, describe, draw and classify one- and two dimensional geometric figures including intersecting, perpendicular and parallel lines, line segments, rays, and angles using given measurements, with inconsistent results.
BELOW STANDARD	• Classify angles and triangles as right, acute, or obtuse, with errors. • Identify and draw circles and elements of circles. • Identify transformations as slides, turns, flips, larger, or smaller, with assistance. • Identify shapes that have congruence and symmetry, with assistance. • Graph ordered pairs and identify coordinates for a given point in the first quadrant, with assistance. • Identify, describe, compare, and classify common two-and three-dimensional figures, with errors. • Identify, describe, and classify one- and two- dimensional geometric figures including intersecting, perpendicular and parallel lines, line segments, rays, and angles, with assistance.

Performance Level Descriptors
Mathematics

Grade 5

Content Standard 5.0	**Data Analysis:** To solve problems, communicate, reason, and make connections within and beyond the field of mathematics, students will collect, organize, display, interpret, and analyze data to determine statistical relationships and probability projections.
EXCEEDS STANDARD	• Collect, organize, and interpret data using a variety of graphic representations. • Use data and graphs to draw conclusions and/or make predictions using data in a variety of written and oral forms, with and without technology. • Conduct simple and compound probability experiments using concrete materials and represent the results in fractional forms. • Solve and analyze probability problems using a variety of methods. • Use measures of central tendency in practical problem situations. • Select a type of graph to represent a given set of data and provide written and oral justification of selection, including discussion of limitations of graphs not selected.
MEETS STANDARD	• Collect, organize, read, and interpret data using graphic representations including tables, line plots, stem and leaf plots, scatter plots, and histograms. • Use data and graphs to formulate and explain conclusions and predictions with and without technology. • Conduct simple probability experiments using concrete materials and represent the results in fractional form. • Solve probability problems using a variety of methods including constructing sample spaces and tree diagrams. • Model and compute measures of central tendency including mean, median, and mode. • Describe the limitations of various graph formats and select a type of graph to accurately represent the given data; justify the selection.
APPROACHES STANDARD	• Read and interpret data using a variety of graphic representations. • Use data to make conjectures and predictions that are sometimes erroneous. • Conduct simple probability experiments using concrete materials and summarize the results. • Solve probability problems primarily using sample spaces and tree diagrams. • Identify the mode and compute the mean and median for a given set of data, with inconsistent results. • Select a type of graph to represent data and identify inconsistently the reasons for the selection.
BELOW STANDARD	• Read and interpret data using simple graphic representations, with assistance. • Use data to make predictions, with inconsistent logic. • Conduct simple probability experiments using concrete materials and tally the results. • Solve simple probability problems primarily using tree diagrams. • Identify the mode and compute the mean and median for a given set of data, with assistance. • Select a type of graph to represent data and identify some of the reasons for the selection, with assistance.

Performance Level Descriptors
Mathematics

Grade 8

Content Standard 1.0	**Numbers, Number Sense, and Computation:** To solve problems, communications, reason, and make connections within and beyond the field of mathematics, students will accurately calculate and use estimation techniques, number relationships, operation rules, and algorithms: they will determine the reasonableness of answers and the accuracy of solutions.
EXCEEDS STANDARD	• Read, write, apply, and compute with real numbers including radicals, exponentials, scientific notation, and irrationals and use them to solve multi-step problems. • Solve multi-step proportion problems involving addition, subtraction, multiplication, and division. • Explain, connect, and apply concepts of number theory and properties of real numbers to solve problems and justify solutions. • Explain, connect, and apply properties of real numbers to solve problems and justify solutions. • Estimate in appropriate practical applications and explain the validity of the estimation method. • Explain and apply the relationships among fractions, decimals, and percents and translate among various representations.
MEETS STANDARD	• Read, write, apply, and compute with real numbers in various forms including radicals, exponentials, and scientific notation. • Determine, write, and use ratios and proportions to solve problems. • Explain and use concepts of number theory such as factors and multiples, and properties of real numbers such as the commutative property and associative property, to solve problems. • Explain and use properties of real numbers such as the associative, commutative, and distributive properties and order of operations to solve problems. • Estimate in problem solving situations and practical applications to determine the reasonableness of answers and verify the results. • Explain the relationship among fractions, decimals, and percents and translate among representations.
APPROACHES STANDARD	• Read, write, and compute with real numbers, including exponentials, with inconsistent results. • Solve proportions using given ratios. • Use factors, multiples, and divisibility rules to solve problems. • Identify and apply some properties of real numbers. • Estimate in practical applications with errors. • Convert among fractions, decimals, and percents, with inconsistent results.
BELOW STANDARD	• Read, write, and accurately compute with whole numbers and add and subtract decimals and fractions, with inconsistent results. • Describe situations as a ratio. • Use factors, multiples, and divisibility rules to solve problems, though with inconsistent results. • Identify and use properties of real numbers, with assistance. • Estimate in problem solving situations and practical applications, with assistance. • Convert between two of the following—common fractions, decimals, and percents—with assistance.

Performance Level Descriptors
Mathematics

Grade 8

Content Standard 2.0	**Patterns, Functions, and Algebra:** To solve problems, communicate, reason, and make connections within and beyond the field of mathematics, students will use various algebraic methods to analyze, illustrate, extend, and create numerous representations (words, numbers, tables, and graphs) of patterns, functions, and algebraic relations as modeled in practical situations.
EXCEEDS STANDARD	• Use inductive reasoning to find a missing term in numeric, arithmetic, and geometric sequences and to generalize basic patterns and formulas to the nth term, with and without calculators. • Identify, model, describe, and evaluate complex relationships including functions using diagrams, written, oral, graphic, and symbolic language. • Solve a complex equation or formula for any variable. • Describe and demonstrate how a change in one variable of a complex mathematical relationship affects the remaining variables. • Solve complex linear equations and inequalities. • Add and subtract polynomials describing the connection between the algebraic and arithmetic processes.
MEETS STANDARD	• Use inductive reasoning to find a missing term in numeric, arithmetic, and geometric sequences and to generalize basic patterns to the nth term, with and without calculators. • Identify, describe, model, and evaluate relationships including patterns, sequences, and functions using oral, written, and symbolic language, with and without technology. • Solve an equation or a formula for any variable. • Describe how a change in one variable of a mathematical relationship affects the remaining variables using various tools and methods. • Model, identify, and solve simple linear equations and inequalities and relate that process to the order of operations, using formal and informal methods. • Add and subtract binomials describing the connection between the algebraic process and the arithmetic process.
APPROACHES STANDARD	• Find a missing term of arithmetic and geometric sequences. • Identify, model, and describe relationships, with inconsistent results, including patterns, sequences, and functions using oral and written language, with and without technology. • Solve an equation or a formula for any variable, with errors. • Describe, in an incomplete or confusing way, how a change in one variable of a mathematical relationship affects the remaining variables. • Identify and solve simple linear equations, with errors. • Add and subtract binomials.
BELOW STANDARD	• Find a missing term in an increasing arithmetic or geometric sequence. • Identify, model, describe, and evaluate simple relationships, including functions, with assistance, with and without technology. • Read and substitute values in an algebraic expression. • Describe, with assistance, how a change in one variable of a mathematical relationship affects the remaining variables. • Solve simple linear equations, though not yet independently. • Add binomials.

Performance Level Descriptors
Mathematics

Grade 8

Content Standard 3.0	**Measurement:** To solve problems, communicate, reason, and make connections within and beyond the field of mathematics, students will use appropriate tools and techniques of measurement to determine, estimate, record, and verify direct and indirect measurements.
EXCEEDS STANDARD	• Use conversion factors to compare and convert units of measure for length, weight/mass, and volume within the same measurement system (customary or metric); estimate conversions between like units of the two systems to solve problems. • Describe the distinction between precision, error of measure, and tolerance in measurement when using an appropriate measurement tool. • Determine an appropriate degree of accuracy and measure to that degree of accuracy for a specified measurement situation. • Recall and apply formulas to find perimeter, circumference, and area of plane figures and volume and surface area of solid figures; identify the relationship between changes in area and volume and changes in linear measures of figures. • Evaluate formulas and algebraic expressions for given values of a variable, using various tools and methods. • Apply ratios and proportions in multi-step problems.
MEETS STANDARD	• Compare and convert units of measure for length, weight/mass, and volume within the same measurement system (customary or metric); estimate conversions between like units of the two systems to solve problems. • Identify the range of precision, error of measure, and tolerance in measurement when using the appropriate measurement tool and measuring to the required degree of accuracy. • Estimate and measure length, weight/mass, and volume to the required degree of accuracy. • Derive and apply formulas to find perimeter, circumference, and area of plane figures and volume and surface area of solid figures; identify the relationship between changes in area and volume and changes in linear measures of figures. • Evaluate formulas and algebraic expressions for given values of a variable. • Apply ratio and proportion to calculate rates and as a method of indirect measure.
APPROACHES STANDARD	• Compare and convert units of measure for length and weight/mass within the same measurement system (customary and metric); estimate conversions between like units of the two systems to solve problems. • Determine the precision of measure for a given measurement tool. • Estimate and measure to a required degree of accuracy, though not yet consistently. • Apply formulas to find perimeter, circumference, and area of plane figures and identify the relationship between changes in area and changes in linear measures, with inconsistent results. • Substitute for given values in an algebraic expression. • Apply ratio and proportion to calculate rates and as a method of indirect measure, with inconsistent results.
BELOW STANDARD	• Convert units of linear, weight, time, and liquid measure within the customary system, with inconsistent accuracy. • Explain how the size of the unit used affects the precision of measurement. • Measure to the nearest whole unit. • Find the area, perimeter, and circumference of common plane figures, with assistance. • Substitute values to evaluate algebraic expressions. • Set up and solve proportions, with assistance.

Performance Level Descriptors
Mathematics

Grade 8

Content Standard 4.0	**Spatial Relationships and Geometry:** To solve problems, communicate, and make connections within and beyond the field of mathematics, students will identify, represent, verify and apply spatial relationships and geometric properties.
EXCEEDS STANDARD	• Identify, classify, compare, and draw regular and complicated irregular polygons, with given specifications and determine the sum of the interior angles of convex polygons, developing a rule to describe the sum. • Apply the properties of equality and proportionality to solve complex problems involving congruent or similar shapes. • Use coordinate geometry and graphs to show multiple-step geometric transformations. • Create a variety of models of a three-dimensional figures from two-dimensional drawings and make two-dimensional proportional sketches of three-dimensional objects. • Represent, interpret, and generalize relationships defined by equations and formulas (including distance, midpoint, and slope) on a coordinate plane, with and without technology. • Form generalizations and validate conclusions about properties of geometric shapes including those associated with parallel lines, perpendicular lines, bisectors, triangles, and polygons and use these generalizations to solve problems. • Verify, explain and use both the Pythagorean Theorem and the Triangle Sum Theorem to determine missing sides and angles of triangles in practical situations. • Construct, draw, and sketch geometric figures, bisected angles and lines, accurately and efficiently using hand tools, technology, and models.
MEETS STANDARD	• Identify, classify, compare, and draw regular and irregular polygons, given specifications; determine the sum of the interior angles of convex polygons. • Apply the properties of equality and proportionally to solve problems involving congruent or similar shapes. • Use coordinate geometry and models to illustrate change in scale and other geometric transformations. • Create a model of a three-dimensional figure from two-dimensional drawings and make a two-dimensional drawing of a three-dimensional object. • Represent and interpret relationships defined by equations and formulas (including distance, midpoint, and slope) on a coordinate plane with and without technology. • Form generalizations and validate conclusions about properties of geometric shapes including those associated with parallel lines, perpendicular lines, bisectors, triangles, and quadrilaterals. • Verify, explain and use both the Pythagorean Theorem and the Triangle Sum Theorem to determine missing sides and angles of triangles. • Construct, draw, and sketch geometric figures, bisected angles and lines and line segments with given specifications, using hand tools and technology.
APPROACHES STANDARD	• Identify, classify, compare, and sketch regular polygons and use a protractor to determine the sum of the interior angles of polygons. • Apply the properties of equality and proportionality to solve simple problems involving congruent or similar shapes. • Identify and compare the ordered pairs for both an original and transformed figure on a coordinate plane, with inconsistent results. • Build a model of a simple three-dimensional figure from two-dimensional drawings and make a two-dimensional drawing of a simple three-dimensional object. • Represent relationships, with errors, defined by equations and formulas (including distance, midpoint, and slope) on a coordinate plane. • Identify and define parallel lines, perpendicular lines, bisectors, triangles and quadrilaterals. • Use both the Pythagorean Theorem and the Triangle Sum Theorem to determine missing sides and angles of triangles with inconsistent results. • Construct figures and bisect angles and line segments using hand tools, technology, and models.

Performance Level Descriptors
Mathematics

Grade 8 (Standard 4.0 continued)

BELOW STANDARD	• Classify, sketch, compare, and identify most regular polygons; determine the sum of the interior angles of polygons given the measurements of the angle. • Apply the properties of equality and proportionality to solve simple problems involving congruent or similar shapes, with inconsistent results. • Identify the ordered pairs that relate to the vertices of a geometric figure on a coordinate plane. • Build a model of a simple three-dimensional figure from a two-dimensional drawing or make a two-dimensional drawing of a simple three-dimensional object, with assistance. • Use a table and plot points in a coordinate plane. • Represent or describe the relationships meant by the terms parallel lines, perpendicular lines, bisectors, triangles, and quadrilaterals. • Use the Pythagorean Theorem to find the hypotenuse, and use the Triangle Sum Theorem with given angle measures to find missing angles. • Construct figures and bisect angles and line segments using hand tools, technology and models, with assistance.

Performance Level Descriptors
Mathematics

Grade 8

Content Standard 5.0	**Data Analysis:** To solve problems, communicate, reason, and make connections within and beyond the field of mathematics, students will collect, organize, display, interpret, and analyze data to determine statistical relationships and probability projections.
EXCEEDS STANDARD	• Organize, display, read, and analyze data with and without technology using a variety of displays. • Determine the theoretical probability of a compound or dependent event using different counting methods including tree diagrams, sample spaces, and organized lists and compare those results with the results of a simulation of an experiment. • Use the odds of an event to determine probability and use the probability of an event to determine the odds of the event. • Differentiate between a permutation and a combination and determine the number of arrangements possible with each situation. • Create graphs to illustrate the possible misleading effects of a scale change or a format change. • Formulate and justify inferences and projections based on interpolations and extrapolations of data to solve problems.
MEETS STANDARD	• Organize, display, read, and analyze data, with and without technology, using a variety of displays including circle graphs, frequency distributions, and box and whisker plots. • Determine the theoretical probability of a simple or independent event using different counting methods including tree diagrams, sample spaces, and organized lists and compare those results with the results of doing the experiment. • Differentiate between the probability of an event and the odds of an event. • Identify the number of combinations possible in given situations using a variety of counting methods. • Evaluate arguments based on data analysis for accuracy and validity and analyze the effect a change of scale or a change of format will have on statistical charts and graphs. • Formulate inferences and projections based on interpolations and extrapolations of data to solve problems.
APPROACHES STANDARD	• Organize, display, read, and analyze data in a variety of displays that contain errors. • Use tree diagrams to create a list to determine the probabilities of a simple event. • Identify when an event is described using odds or probability. • Find the number of combinations possible in given situations, with inconsistent results. • Analyze the effect a change of scale and change of format have on statistical charts and graphs. • Formulate projections based on interpolations or extrapolations of data.
BELOW STANDARD	• Read and analyze data using a variety of displays, with assistance. • Find the probability of an event from a sample space. • Distinguish between odds and probability, though not yet consistently. • Find the number of combinations possible in simple, given situations. • Analyze the effect a change of scale or a change of format has on statistical charts and graphs. • Formulate projections based on interpolations or extrapolations of data that are not always reasonably supported by the data.

Performance Level Descriptors
Mathematics

Grade 12

Content Standard 1.0	**Numbers, Number Sense, and Computation:** To solve problems, communicate, reason, and make connections within and beyond the field of mathematics, students will accurately calculate and use estimation techniques, number relationships, operation rules, and algorithms; they will determine the reasonableness of answers and the accuracy of solutions.
EXCEEDS STANDARD	• Calculate and estimate sums, differences, products, quotients, powers, and roots, using mental mathematics, applying complex formulas, and algorithms. • Apply the laws of exponents to perform operations on complex expressions with and without technology. • Apply properties and theories of the real number system to complex practical situations. • Perform complex operations on matrices, with and without technology.
MEETS STANDARD	• Calculate and estimate sums, differences, products, quotients, powers, and roots, applying formulas and algorithms. • Apply the laws of exponents to perform operations on expressions with integral exponents and scientific notation. • Apply properties and theories of the real number system to practical situations. • Add, subtract, and scalar multiply matrices.
APPROACHES STANDARD	• Calculate and estimate sums, differences, products, quotients, powers, and roots, applying simple formulas and algorithms. • Apply the laws of exponents to perform operations on expressions with integral exponents and scientific notation, with inconsistent results. • Solve simple, real practical problems using properties and theorems of the real number system, with some errors in the results. • Add, subtract, and scalar multiply matrices, though not yet consistently.
BELOW STANDARD	• Calculate with real numbers using given formulas or algorithms. • Use the laws of exponents and scientific notation for sums, differences, products, and quotients with numbers, though the results may contain errors. • Solve practical problems using properties and theorems of the real number system, with assistance. • Add and subtract using matrices.

Performance Level Descriptors
Mathematics

Grade 12

Content Standard 2.0	**Patterns, Functions and Algebra Performance Standards:** To solve problems, communicate, reason, and make connections within and beyond the field of mathematics, students will use various algebraic methods to analyze, illustrate, extend, and create numerous representations (words, numbers, tables, and graphs) of pattern, functions, and algebraic relations as modeled in practical situations.
EXCEEDS STANDARD	• Represent, analyze, and solve complex problem situations using discrete models, with and without technology. • Develop and use different forms of a variety of equations, proportions, and/or formulas, solving for different variables in different situations. • Compute with polynomials and analyze the connections between the algebraic processes and arithmetic processes. • Use quadratic equations to solve practical and mathematical problems, with and without technology. • Model practical problems from everyday situations and translate them into numerous forms including matrices, tabular, symbolic, and graphical representations of functions, with and without technology. • Determine the domain and the range of linear relations given a graph or a set of ordered pairs and explain the importance of the domain and range in complex problem solving situations. • Solve systems of equations algebraically and graphically, using graphing calculators as a primary problem-solving tool and to verify solutions found by other methods.
MEETS STANDARD	• Represent, analyze, and solve problem situations using discrete models, including graphs and matrices, with and without technology. • Create and use different forms of a variety of equations, proportions, and/or formulas, solving for the needed variable as necessary in given situations. • Add, subtract and multiply polynomials, factor 1st and 2nd degree polynomials, and describe the process and connection between the algebraic process and arithmetic process. • Use simple quadratic equations with integer roots to solve practical and mathematical problems. • Model practical situations mathematically and translate a practical problem into a variety of mathematical forms including matrices and tabular, symbolic, and graphical representations of functions, with and without technology. • Determine the domain and the range of linear relations given a graph or a set of ordered pairs and explain the importance of the domain and range in problem solving situations. • Solve systems of two linear equations algebraically and graphically, using graphing calculators as a primary problem-solving tool and to verify solutions found by other methods.
APPROACHES STANDARD	• Represent, analyze, and solve problems, with inconsistent results, using discrete models, including graphs and matrices, with and without technology. • Create and use different forms of simple equations, proportions, and/or formulas, solving for the needed variable as necessary in given situations, though not yet consistently. • Add, subtract, and multiply polynomials, factor 1st and 2nd degree polynomials, though not yet consistently, and describe the process and connection between the algebraic process and arithmetic process. • Use simple quadratic equations with integer roots to solve practical and mathematical problems using a graphing calculator, with results that may contain errors. • Model practical problems from everyday situations and translate them into a variety of forms including matrices and tabular, symbolic, and graphical representations of functions, which may contain errors, with and without technology. • Determine the domain and the range of linear relations given a graph and a set of ordered pairs, with inconsistent results. • Solve systems of two linear equations both algebraically and graphically using graphing calculators, with inconsistent results.

Performance Level Descriptors
Mathematics

Grade 12 (Standard 2.0 continued)

BELOW STANDARD	• Analyze and solve problems using discrete models, including simple graphs and tables, with and without technology with assistance. • Solve problems using simple equations, proportions, and/or formulas, though not yet independently. • Add, subtract, and multiply polynomials, with assistance. • Identify integer roots of simple quadratic equations using a graphing calculator, though not yet consistently. • Model practical problems of functions from everyday situations using tables and graphs and technology. • Determine the domain and the range of a given set of ordered pairs. • Solve systems of two linear equations, both algebraically and graphically, using graphing calculators, with assistance.

Performance Level Descriptors
Mathematics

Grade 12

Content Standard 3.0	**Measurement:** To solve problems, communicate, reason and make connections within and beyond the field of mathematics, students will use appropriate tools and techniques of measurement to determine, estimate, record, and verify direct and indirect measurements.
EXCEEDS STANDARD	• Distinguish, differentiate, and convert units of measure among and between customary and metric systems, monetary systems and use the applications in other disciplines. • Select and use measurement tools, techniques, and formulas to calculate and compare rates, costs, distances, interests, temperatures, weights/masses, and other complex measures. • Justify and communicate the differences between accuracy, precision, error of measure, and tolerance in measurement and describe how each of these can affect solutions found in complex real world problems. • Use and interpret consumer data to make informed predictions and financial decisions. • Generate and use relationships and generate formulas to determine the measurement of unknowns to solve sophisticated problems.
MEETS STANDARD	• Distinguish, differentiate, and convert units of measure among and between customary and metric systems and between monetary systems. • Select and use measurement tools, techniques, and formulas to calculate and compare rates, costs, distances, interests, temperatures, and weights/masses. • Justify and communicate the differences between accuracy, precision, error of measure, and tolerance in measurement and describe how each of these can affect solutions found in problem situations. • Use and interpret consumer data such as amortization tables, tax tables, and compound interest charts to make informed financial decisions related to practical applications such as budget. • Use relationships and formulas to determine the measurement of unknown dimensions, angles, areas, and volumes to solve problems.
APPROACHES STANDARD	• Distinguish, differentiate, and convert units of measure among and between customary and metric systems and between monetary systems, though not yet consistently. • Select and use measurement tools, techniques, and formulas to calculate and compare rates, costs, distances, interests, temperatures, and weights/masses, though not yet consistently. • Identify and communicate the differences between accuracy, precision, error of measure and tolerance in measurement and identify how they can affect solutions in problem situations with explanations that indicate incomplete understanding. • Use and interpret consumer data, with inconsistent results, such as amortization tables, tax tables, and compound interest charts. • Use relationships and formulas to determine the measurement of unknown dimensions, angles, areas, and volumes to solve simple problems, with inconsistent results.
BELOW STANDARD	• Distinguish between and convert units of measure within customary and metric systems and between monetary systems, with assistance. • Use given measurement tools, techniques, and formulas to calculate and compare rates, costs, distances, interests, temperatures, and weights/masses, with assistance. • Identify the differences between accuracy, precision, error of measure, and tolerance in measurement. • Read and interpret consumer data related to practical applications such as budget. • Use given formulas to determine the measurement of unknown dimensions, angles, areas, and volumes to solve simple problems, with assistance.

Performance Level Descriptors
Mathematics

Grade 12

Content Standard 4.0	**Spatial Relationships and Geometry:** To solve problems, communicate, and make connections within and beyond the field of mathematics, students will identify, represent, verify, and apply spatial relationships and geometric properties.
EXCEEDS STANDARD	• Identify and use the properties of polygons, including determining measures of interior and exterior angles, and elements of circles to solve complex, practical problems. • Use coordinate geometry to graph linear equations, determine slopes of lines, identify parallel and perpendicular lines, find solutions to sets of equations, and apply algebraic techniques to solve problems determined by geometric relationships. • Use multi-step algebraic methods to solve problems involving geometric relationships. • Use angles, theorems, and relationships to solve practical problems. • Apply the Pythagorean Theorem, its converse, properties of special right triangles, and trigonometric functions to solve a variety of practical problems. • Use tools, technology, and models to sketch, draw, and construct geometric figures in order to solve problems and to demonstrate and verify geometric properties. • Construct, justify, and defend mathematical conclusions using alternative methods supported by established mathematical principles.
MEETS STANDARD	• Identify and use the properties of polygons, including determining measures of interior and exterior angles, and elements of circles to solve practical problems. • Use coordinate geometry to graph linear equations, determine slopes of lines, identify parallel and perpendicular lines, and find possible solutions to sets of linear equations. • Use algebraic techniques to solve problems involving geometric relationships. • Use complementary and supplementary angles, congruent angles, vertical angles, angles formed when parallel lines are cut by a transversal, and angles in polygons to solve practical problems. • Apply the Pythagorean Theorem, its converse, properties of special right triangles, and right triangle trigonometry (sine, cosine, and tangent) to solve practical problems. • Use tools, technology, and models to sketch, draw, and construct geometric figures in order to solve problems and to demonstrate the properties of geometric figures. • Construct, justify, and defend mathematical conclusions using logical, sequential, and deductive reasoning supported by established mathematical principles.
APPROACHES STANDARD	• Identify and use the properties of polygons, including determining measures of interior and exterior angles, and elements of circles to solve simple practical problems, though not yet consistently. • Use coordinate geometry to graph linear equations, determine slopes of lines, identify parallel and perpendicular lines, and find solution sets for simple linear equations, though not yet consistently. • Use algebraic techniques to solve problems involving simple geometric relationships. • Use complementary and supplementary angles, congruent angles, vertical angles, angles formed when parallel lines are cut by a transversal, and angles in polygons to solve simple problems, though not consistently. • Apply the Pythagorean Theorem, its converse, properties of special right triangles, and right triangle trigonometry to solve practical problems, with inconsistent results. • Use tools, technology, and models to sketch, draw, and construct geometric figures that may contain inaccuracies, sometimes using the constructions to solve problems or demonstrate properties of geometric figures. • Construct, justify, and defend mathematical conclusions using logical, sequential, deductive reasoning supported by established mathematical principles, though the logic is applied inconsistently.

Performance Level Descriptors
Mathematics

Grade 12 (Standard 4.0 continued)

BELOW STANDARD	• Use given properties of polygons, including determining measures of interior and exterior angles, and elements of circles to solve simple practical problems, with assistance. • Use ordered pairs to graph linear equations, determine slopes of lines, identify parallel and perpendicular lines, and find possible solutions sets for simple linear equations, with assistance. • Use algebraic techniques to solve problems involving simple geometric relationships, with assistance. • Use complementary and supplementary angles, congruent angles, vertical angles, angles formed when parallel lines are cut by a transversal, and angles in polygons to solve simple problems, with assistance. • Apply the Pythagorean Theorem and the Triangle Sum Theorem to solve practical problems. • Use tools, technology, and models to sketch, draw, and construct simple geometric figures, with assistance. • Construct and explain mathematical methods and conclusions, but not necessarily using established mathematical principles.

Performance Level Descriptors
Mathematics

Grade 12

Content Standard 5.0	**Data Analysis:** To solve problems, communicate, reason, and make connections within and beyond the field of mathematics, students will collect, organize, display, interpret, and analyze data to determine statistical relationships and probability projections.
EXCEEDS STANDARDS	• Use calculators and computers to create, manipulate, and interchange among and between tables, graphs, and matrices when communicating statistical information. • Generate a bar graph or line graph that approximates normal distributions to compare and analyze information. • Design, conduct, analyze, and communicate the results of multi-stage probability and statistical experiments using graphical representations. • Identify and create a probability situation that is a permutation or a combination and find the number of possible outcomes using a variety of methods, with and without technology. • Apply the measures of central tendency appropriately in problem solving situations. • Apply and interpret measures of dispersion. • Analyze the validity of statistical conclusions noting various sources of bias such as misuse and abuse of data and recommend successful methods to remedy bias.
MEETS STANDARD	• Use calculators and computers to create and manipulate tables, graphs, and matrices to communicate statistical information. • Use the shape of graphs of normal distributions to compare and analyze information. • Design, conduct, analyze, and communicate the results of multi-stage probability and statistical experiments. • Identify a probability situation as a permutation or a combination and find the number of possible outcomes, with and without graphing calculators. • Select and use the measures of central tendency such as mean, median, and mode that are appropriate for given situations. • Select and use measures of dispersion including range, distribution, and possible outliers that are appropriate for given situations. • Analyze the validity of statistical conclusions noting various sources of bias and misuse and abuse of data caused by a variety of factors.
APPROACHES STANDARD	• Use calculators and computers to create and manipulate tables, graphs, and matrices to communicate statistical information, though not always clearly or accurately. • Use the shape of graphs of normal distributions to compare and analyze information, with inconsistent results. • Conduct, analyze, and communicate the results of multi-stage probability and statistical experiments. • Identify a probability situation as a permutation or a combination and find the possible outcomes, though not yet consistently, with or without a graphing calculator. • Select and use the measures of central tendency such as mean, median, and mode, with inconsistent results. • Select and use measures of dispersion including range and standard deviation, with inconsistent results. • Recognize statistical bias, misuse, and abuse of data, though not yet consistently.
BELOW STANDARD	• Use calculators and computers to create tables, graphs, and matrices to communicate statistical information that is incomplete or contains errors. • Identify the shape of normal distributions when given examples of graphs. • Conduct, analyze, and communicate the results, which may contain errors, of single-stage probability and statistical experiments. • Use a given algorithm for probability situations, and calculate the number of possible outcomes of permutations and combinations. • Calculate measures of central tendency such as mean, median, and mode with assistance. • Identify the range of a given set of data. • Recognize statistical bias, misuse, and abuse of data caused by a wide variety of factors, with assistance.

Performance Level Descriptors
Mathematics

Process Standards
Grades K-12

Process Standard 6.0	**Problem Solving:** Students will develop their ability to solve problems by engaging in appropriate problem solving opportunities in which there is a need to use various approaches to investigate and understand mathematical concepts in order to: formulate their own problems; find solutions to problems from everyday situations; develop and apply strategies to solve a wide variety of problems; and integrate mathematical reasoning, communication, and connections.
EXCEEDS STANDARD	• Use rigorous, sophisticated strategies and techniques to solve traditional and related non-traditional problems. • Analyze and evaluate the validity of solutions and the effectiveness and efficiency of problem solving strategies and processes employed. • Experiment with tools and techniques to enhance problem solving ability.
MEETS STANDARD	• Use efficient approaches to investigate and understand mathematical concepts. • Formulate problems. • Find solutions to problems that occur in everyday situations. • Select, modify, develop, and apply strategies to solve a wide variety of problems. • Transfer and generalize previous experience to new problem solving situations. • Demonstrate persistence in problem solving. • Explain and verify results. • Use technology as a tool in problem solving.
APPROACHES STANDARD	• Use problem solving strategies and techniques, with inconsistent results. • Describe problem solving processes and solutions, with assistance. • Use basic tools and processes, with limited effectiveness.
BELOW STANDARD	• Require assistance to identify problem-solving strategies, and frequently employ processes incorrectly. • Describe solution processes, with assistance. • Use basic tools and processes, with minimal effectiveness.

Performance Level Descriptors
Mathematics

Process Standards
Grades K-12

Process Standard 7.0	**Communication:** Students will develop their ability to communicate mathematically by solving problems in which there is a need to obtain information from the real world through reading, listening, and observing in order to: translate this information into a mathematical language and symbols; process this information mathematically; and present results in written, oral and visual formats.
EXCEEDS STANDARD	• Use language, symbolism, and visual representations to clearly and concisely convey and justify mathematical information, ideas, and arguments. • Employ a variety of sophisticated communication tools and techniques to examine, analyze, and synthesize mathematical information, ideas, and arguments. • Present original mathematical conjectures, arguments, and evaluations using sophisticated communication tools and techniques.
MEETS STANDARD	• Obtain information from the real world through reading, listening, observing, and inquiring and use this information to solve mathematical problems. • Use mathematical language and symbols to explain thinking and processes and translate those ideas into everyday language. • Present mathematical ideas and solutions in written, oral, and visual forms. • Discuss, explain, justify, and evaluate mathematical ideas and solutions. • Use physical, pictorial, and symbolic forms to represent mathematical ideas and relationships. • Make conjectures, present arguments, and evaluate discussions regarding mathematical ideas presented in various forms including written and oral.
APPROACHES STANDARD	• Use simple language, and graphic representations to describe mathematical information, strategies, and ideas. • Present mathematical ideas and information in oral, written, symbolic, and graphic form, with some assistance.
BELOW STANDARD	• Use simple language and graphic representations to describe and represent mathematical information and ideas, with regular assistance. • Present simple mathematical ideas and information in oral or pictorial form, with some assistance.

Performance Level Descriptors
Mathematics

Process Standards
Grades K-12

Process Standard 8.0	**Reasoning:** Students will develop their ability to reason mathematically by solving problems in which there is a need to investigate significant mathematical ideas and construct their own learning in all content areas in order to justify their thinking; reinforce and extend their logical reasoning abilities; reflect on and clarify their own thinking; and ask questions to extend their thinking.
EXCEEDS STANDARD	• Demonstrate clear, coherent, and insightful understanding of problem situations. • Utilize creative strategies and sophisticated processes to resolve traditional and non-traditional problems. • Use strong mathematical arguments, clear diagrams, and appropriate examples and counterexamples to justify and support thinking and solutions.
MEETS STANDARD	• Construct meaning and justify thinking by investigating mathematical ideas, patterns, and relationships. • Reinforce and extend logical reasoning abilities. • Ask questions to reflect on, clarify, and extend thinking. • Review, refine, explain, and justify mathematical processes, arguments and solutions using manipulatives, physical models, and abstract ideas. • Determine relevant and/or sufficient information to solve mathematical problems. • Follow, create, and defend valid logical mathematical arguments. • Recognize and apply inductive and deductive reasoning in both concrete and abstract contexts.
APPROACHES STANDARD	• Interpret problem situations, with some assistance. • Utilize simple strategies and processes in problem situations. • Demonstrate understanding of mathematical ideas and processes, though occasionally with faulty or ambiguous explanations.
BELOW STANDARD	• Require significant assistance to recognize problem situations. • Use simple problem solving strategies and processes, though not yet consistently. • Describe situations or data that do not reflect the problem or which misrepresent the problem situation.

Performance Level Descriptors
Mathematics

Process Standards
Grades K-12

Process Standard 9.0	**Connections:** Students will develop the ability to make mathematical connections by solving problems in which there is a need to view mathematics as an integrated whole, identifying relationships between content strands, and integrating mathematics with other disciplines, allowing the flexibility to approach problems in a variety of ways within and beyond the field of mathematics.
EXCEEDS STANDARD	• Recognize and use subtle implications of relationships which are common in everyday situations, mathematics, and across disciplines. • Apply existing knowledge and skills to new and unfamiliar problem situations. • Demonstrate and explain the relationship of concepts to procedures using sophisticated models and precise mathematical language.
MEETS STANDARD	• View mathematics as an integrated whole and identify relationships between content strands. • Identify practical applications of mathematical principles that can be applied to other disciplines. • Use and analyze the connections within and beyond the field of mathematics in a variety of ways to solve problems. • Link new concepts to prior knowledge. • Explain the relationship of concepts to procedures using models. • Apply mathematical thinking and modeling to solve problems that arise in other disciplines and in everyday life.
APPROACHES STANDARD	• Recognize mathematical relationships in everyday situations and between content strands within mathematics, with assistance. • Transfer existing knowledge and skills to similar problem situations. • Match concepts to procedures when using models.
BELOW STANDARD	• Use mathematics in everyday situations, with assistance. • Apply existing knowledge and skills to similar problem situations, with assistance. • Use models to recognize the relationship of concepts to procedures, with assistance.

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